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COMMERCIAL FISHERIES REVIEW

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COMMERCIAL FISHERIES REVIEW

A REVIEW OF DEVELOPMENTS AND NEWS OF THE FISHERY INDUSTRIES
PREPARED IN THE DIVISION OF COMMERCIAL FISHERIES

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Applications for COMMERCIAL FISHERIES REVIEW, which is mailed free to members of the fishery industries and allied interests, should be addressed to the Director, Fish and Wildlife Service United States Department of the Interior, Washington, 25, D.C.

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COMMERCIAL FISHERIES REVIEW

February 1947 Washington 25, D.C. Vol. 9, No.2

THE ELECTROSTATIC SMOKING OF SARDINES

By William S. Hanim* and Walter A. Rust*

ABSTRACT

In experiments on a semi-commercial scale, sardines were electrostatically smoked in unsealed cans. As the cans were conveyed through the smoking chamber, they formed the negative side of an electric field of 14,000 to 23,000 volts. In about 12 seconds passage time, the sardines were sufficiently smoked, and the conveyor carried the cans onward to be filled with oil and sealed.

Best results were obtained when the smoke passed from the smoke furnaces through a washing chamber--where soot and some of the moisture and acrid components were deposited--and then through a heater before entering the smoke precipitation chamber.

- - - - -

Preliminary experiments conducted at the University of Maine[1/] indicated that sardines might be smoked in the canneries by means of electrostatic precipitation. The Fish and Wildlife Service was then requested to test the practicality of employing this method in commercial operations.

In the course of these tests, a pilot-plant apparatus was developed which is capable of smoking the sardines in the cans at a rate of 400 cans per minute. (Present methods of smoking require from ½ to 2 hours, the rate of smoking depending on the amount of equipment and space available.) Several hundred cases of sardines have been electrically smoked in this apparatus and distributed commercially.

Equipment Used and Method of Operation

The pilot smoking plant is illustrated in Figure 1.[2/] It has five main parts:

1. A smoke precipitation chamber D through which the fish pass on the conveyor M
2. A source of high-voltage electric current A
3. A smoke producer E
4. A smoke washer and dehumidifier G
5. A smoke heater F

* Chemical Engineer and Chemist, respectively, Fishery Technological Laboratory, Division of Commercial Fisheries, Boston, Mass. (Eastport, Maine, station). Most of this work was done at the plant of the B. H. Wilson Fisheries Company.

1/Under the supervision of Professor A. S. Hill of the University of Maine and Dr. R. P. Whitney of the Department of Industrial Cooperation. Earlier research along these lines was conducted by the Fisheries Research Board of Canada, but the experiments were discontinued and the results were not published.

2/Drawing by Boris O. Knake, Fishery Engineer, Fishery Technological Laboratory, Division of Commercial Fisheries, Boston, Mass.

The Precipitation Chamber: The precipitation chamber D is merely a box whose floor is the conveyor M that carries the sardines. The two walls parallel to the conveyor extend a short distance below the conveyor, and glass panes between these walls and the conveyor prevent smoke leakage. The ionizer C is formed of parallel, B and S number 32, chromel wires, spaced 3 inches apart and supported by a steel

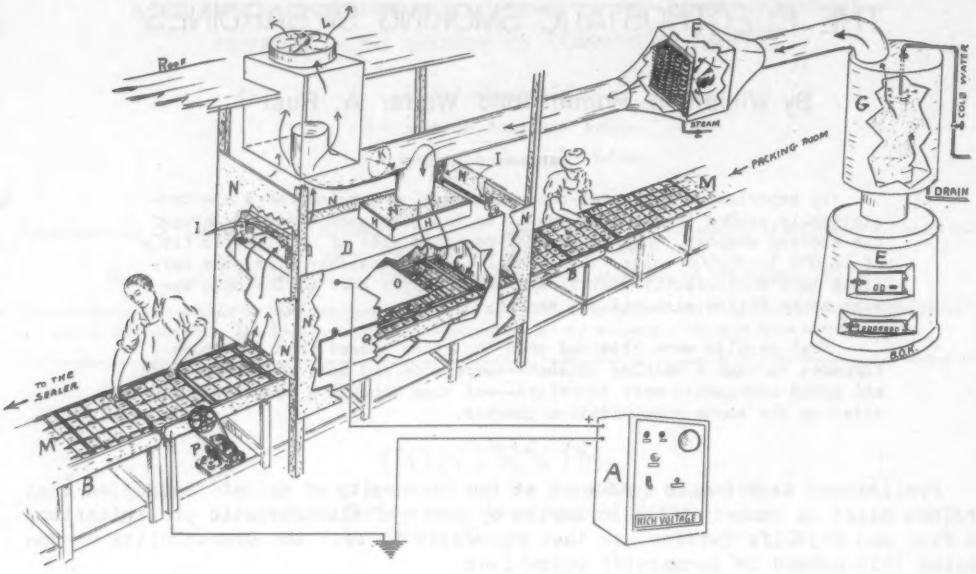


FIGURE 1 - PILOT SMOKING PLANT

A - HIGH-VOLTAGE CURRENT SOURCE
B - CONVEYOR
C - POSITIVELY CHARGED GRID
D - METAL SMOKE PRECIPITATION CHAMBER
E - SMOKE PRODUCER
F - SMOKE HEATER
G - SMOKE WASHER AND DEHUMIDIFIER
H - GLASS-PANE INSULATORS
I - SUPPORT INSULATORS
K - BY-PASS DAMPER
L - EXHAUST
M - PANS
N - ASBESTOS GUARDS
O - BAFFLE
P - MOTOR CONVEYOR DRIVE
Q - DOOR IN SMOKE PRECIPITATION CHAMBER

frame. It is suspended about 1½ inches above the top level of the sardines which pass beneath. This ionizer section is connected to the positive side of the source A of the high voltage current, and the conveyor is connected to the negative side through the ground. As the smoke particles enter the electrical field created by the ionizer, they acquire a positive charge, are attracted toward the sardines, which have received a negative charge from the conveyor, and quickly precipitate upon the sardines. The baffle O is used to cause the smoke to enter the electrical field at one end of the chamber and travel through the box in a strong electrical field. This prevents any bypassing at the exit end and improves the efficiency of the smoke precipitation.

The first chamber used was 60 inches long by 24 inches wide by 36 inches high and was constructed of asbestos board. Although all the experiments on large-scale smoking were carried out in this chamber, it had an important defect. The chamber walls and the supporting frame for the ionizer were electrically insulated from the ionizer itself, and, having the same charge as the conveyor, they soon accumulated large deposits of smoke.

To remedy this defect, the asbestos-board chamber has been replaced by one constructed of 26-gauge galvanized iron. The metal chamber is connected direct-

ly to the ionizer, and since the chamber walls now carry the same charge as the ionizer, they repel, rather than attract, the smoke particles.

The smoke duct and the conveyor are electrically insulated from the chamber by the panes of glass H. These are removable so that, if they become fouled and allow electrical leakage, they can be easily cleaned. Enclosing the chamber, and somewhat separated from it, are panels of asbestos board N to protect the workers from accidental contact with the positively charged metal surface.

The conveyor is similar to those in common use in the Maine sardine canneries. It moves the fish at a speed of 25 feet per minute, carrying them through the precipitation chamber in 12 seconds.

In the earlier experiments, the sardines were conveyed through the precipitation chamber on flakes immediately after having been steamed and air-dried in accordance with the customary preparation procedure. In later experiments, it was found that more satisfactory smoking was obtained when the steamed and air-dried sardines were first packed in the cans and then conveyed through the precipitation chamber just before the oil was added to the cans and they were passed on to the sealing machine.

The Source of High Voltage Current: The electric field which causes the smoke to precipitate on the sardines is derived from a combined transformer and rectifier which operates on 110-volt alternating current and is capable of producing open-circuit; direct-current potentials of from 14,000 to 23,000 volts. Units requiring about 200 watts are satisfactory for this work. These units are furnished by several companies and come equipped with fuses for proper operation. After being started, the unit operates automatically, and the current is cut if any short circuit occurs. In the event of short circuits to the conveyor, it is impossible to receive a shock, as the conveyor is thoroughly grounded. Shocks which might be received by workers opening the access doors to the smoke chamber when the current is on can be avoided through arrangement of the wiring so that the circuit from the primary current to the high-voltage source will be interrupted when the doors are opened. Further installation specifications can be obtained from the firms supplying the high-voltage equipment.

The Smoke Producer: Two 42-inch, ordinary, wood-burning furnaces E are used for the production of smoke, although only one is shown in the diagrammatic sketch. A hot wood fire is started, and when it burns down to coals, these are smothered with hardwood sawdust to produce a thick smoke. If there is any open flame in the furnace during the smoking process, a black, sooty deposit will form on the fish.

The Smoke Washer and Dehumidifier: From the furnace, the smoke passes through a smoke duct 9 inches in diameter into a 50-gallon drum G which is packed with bricks continuously wetted by a stream of cold water. The smoke is cooled to below its dew point, and it deposits a considerable portion of its moisture content. Any traces of soot and some of the bitter and acrid ingredients of the smoke are removed in this treatment, thus giving a better color and flavor to the final product.

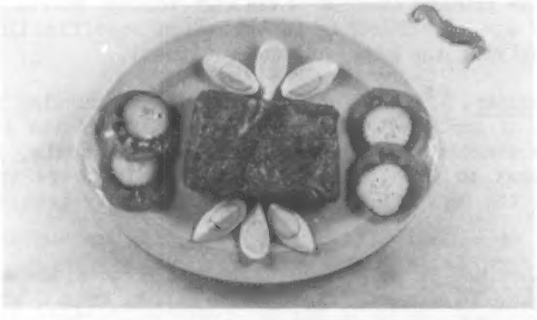
The Smoke Heater: The smoke is then warmed somewhat by being passed through a duct containing the finned steam coil F. Raising the temperature lowers the relative humidity of the smoke sufficiently so that water, which would cause current leakage, does not tend to condense on the insulators in the precipitation chamber. The amount of heating required in this operation depends on whether

the dehumidifier is used, and also on the temperature of the smoke chamber. A temperature of about 200° F. was found sufficient in the experiments carried out without the use of the dehumidifier, and this method of operation is satisfactory if no soot is present in the smoke.

Observations and Discussion: When the precipitation chamber is being operated, an occasional sardine may pass too close to the ionizer wires. An arc will then form across the gap, sometimes breaking the wire and causing a short circuit. The apparatus must then be shut down until the broken wire can be replaced. Some of the later experiments indicate that this trouble might be satisfactorily eliminated by the use of a set of sharpened wires so fixed that they point toward the conveyor.

The greatest difficulty encountered is in the uniform production of smoke of the desired quality. In the furnaces used, the smoke of greatest density, which is the most suitable, is formed just before the sawdust breaks into flame. As soon as an open flame breaks out, however, soot deposits on the fish. Thus, although the furnaces produce good quality, heavy smoke for short periods, they are not suitable for continuous operation of the precipitation chamber. Other systems of smoke production should be tried in future experiments. For example, an electrically heated metal plate over which the sawdust is moved mechanically has been found satisfactory in other smoking experiments carried on by the Service. A similar device was successfully employed in the preliminary experiments on electrical smoking that were carried out at the University of Maine and has also been employed for the commercial smoking of fish.

BROILED SMOKED FISH



Wash, clean, and freshen the smoked fish in cold water for one hour, or longer if necessary. Drain, dry, and sprinkle well with butter or cooking oil. The broiler should be preheated to 350° F. Place on the rack, flesh side up. Broil 3 minutes, then turn and finish broiling 4 minutes. Serve with lemon, butter, or if preferred, the melted butter and pepper. Larger fish would need several more minutes of broiling.

--Fishery Leaflet No. 18

SHALLOWER STORAGE PENS IMPROVE FISH QUALITY

By Joseph F. Puncochar* and Samuel R. Pottinger**

ABSTRACT

Fish and ice were packed in a storage pen of a fishing vessel. The pressure at the bottom was measured for piles of different heights and after varying periods of settling. The pressures recorded reached 446 pounds per square foot for a pile 52 inches high which had been settling for 3 days. Shallower packing would reduce the pressure and lead to the landing of fish of better quality.

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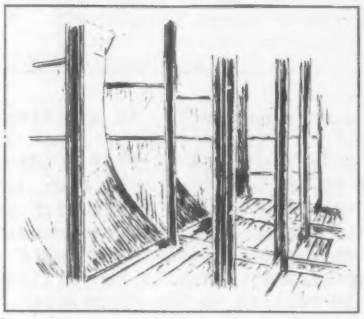

FIGURE 1 - HOLD WITHOUT PEN BOARDS

Observations of fish landed at Boston showed that, when other factors were equal, those fish which had been held aboard the vessels in the lower layers of deeply-packed pens were considerably inferior in quality to the fish that had been in the upper layers or in shallow pens.

The reason for this difference is shown by measurements which demonstrate how the pressure on the lower fish increases with the depth of the pile and also with the passage of time, during which the ice melts and the fish pack down more tightly.

In the holds of most fishing vessels (Figure 1) there are a series of slotted vertical posts into which pen boards, approximately 4½ feet long by 6 to 10 inches wide, can be inserted, as desired, to provide pens for storage of the catch. As the fish are stowed with crushed ice, each pen is generally subdivided, especially on the larger vessels, by the additional insertion of horizontal boards to give two or more compartments, one above the other, which vary in height from 4 to 5 feet.

To measure the pressure to which the fish are subjected at various depths, a slightly inflated rubber bladder, which had airtight connections through copper tubing to a manometer, was placed at the bottom of the pen. Then fish (haddock) and ice were placed in the pen (Figure 2) to a depth of 24 inches

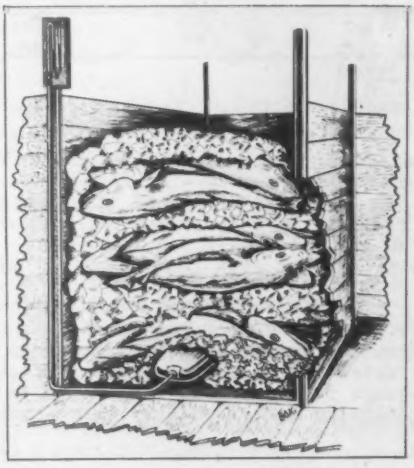

FIGURE 2 - PRESSURE RECORDING DEVICE

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Illustrations by Boris O. Knake, Fishery Engineer, Fishery Technological Laboratory, Boston, Mass.
The authors and illustrator are members of the staff of the Division of Commercial Fisheries.

in the manner described by Knake (1946). When the apparatus reached constant temperature, the manometer showed that the pressure on the bladder was 86 pounds per square foot.

Each day thereafter the pile was built up to a higher level with more fish and ice, and the new pressure reading was recorded. These readings are shown in Table 1. By the fifth day, the height of the pile had reached 60 inches, and the pressure reading was 346 pounds per square foot.

Table 1 - Pressure on Fish at Various Depths in Fish Pens

Days in pen	Depth of fish and ice in pen	Pressure
Number	Inches	Lbs. per sq. ft.
0	24	86
1	32	144
2	48	216
3	50	245
4	56	317
5	60	346

To show how the pressure varied with time at a constant depth, an additional experiment was carried out. The bladder was placed at the bottom of a pen and covered with ice and fish as before to a depth of 52 inches. The initial pressure at constant temperature was found to be 389 pounds per square foot. On each succeeding day any decrease in the height of the pile was made up with fresh fish and ice, and the pressure again determined. By the third day, the pressure reading for the 52-inch pile had risen to 446 pounds per square foot, as shown in Table 2. The decreases in height that had to be made up were evidently due to the settling of the pile and, perhaps, compression of the fish, as well as to the expression of their body juices and melting of the ice.

Table 2 - Pressure on Fish at Constant Depth of 52 Inches

Days in pen	Depth of fish and ice in pen	Pressure
Number	Inches	Lbs. per sq. ft.
0	52	389
1	52	389
2	52	432
3	52	446

Upon examination of the fish stored in the deep pen, it was found that those from the lower part were badly crushed and were considerably inferior to those that had been stored in shallower pens. In similar experiments, Ellison (1934) demonstrated that fish lose 10 to 12 percent in weight during storage in deep pens.

From these experiments it is obvious that, to reduce the bruising of fish aboard many of the larger vessels, shallower pens should be used. In fish pens about 30 inches deep, or approximately one-half the present depth, the pressure exerted on the bottom layer of fish would be reduced to 144 pounds, or less, per square foot, and the fish would lose less weight, have fewer bruises, and be of generally better quality when landed.

LITERATURE CITED

ELLISON, W. A., JR.

1934. Prevention of spoilage at sea. Part 2, The Hold. Fishing Gazette. April. Vol. 51, No. 4, pp. 17-19.

KNAKE, B. O.

1946. Icing fish at sea. Fishery Leaflet 189. U. S. Fish and Wildlife Service, Chicago 54, Ill.

TOUGHENING OF FROZEN CRAB MEAT CAN BE RETARDED

By Martin Heerdt, Jr.*

ABSTRACT

Crab meat hermetically sealed in a partial vacuum retains its original tenderness, color, and flavor in frozen storage more effectively than crab meat sealed in moisture-vapor-resistant cellophane or packed in friction-top tins. In short, toughening and other deleterious effects can be materially retarded, in fact almost prevented, by the partial-vacuum packaging. The hermetically sealed, partial-vacuum package may be effective for one of two reasons or both: It excludes atmospheric oxygen and reduces the amount of oxygen present in the package at the time of sealing, and it prevents moisture losses that may be significant, even though small.

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Fresh-picked Dungeness crab meat possesses a pleasing aroma, delicate flavor, attractive appearance, and a very desirable texture. Because of the seasonal nature of the crab fishery, the fresh product does not appear on the market in uniform quantities throughout the year. During the winter and spring months, when the catch of crab is large, some method of preservation must be utilized. The fresh characteristics of crab meat are not lost in preservation by freezing; therefore, the frozen product commands a better price than canned crab meat, and freezing is more extensively used.

Unfortunately, Dungeness crab meat does not retain its original quality for any length of time when placed in frozen storage. Within a relatively short storage period, it begins to lose its flaky texture and becomes increasingly tough. A gradual loss of desirable flavor and color accompanies this toughening process. The following work was planned as a means of studying factors controlling the amount of toughening and other changes that take place during storage.

EXPERIMENTAL PROCEDURE: Live Dungeness crabs in sufficient quantity to provide a supply of fresh-picked crab meat for this experiment were butchered to remove the viscera and all inedible portions, washed in running fresh water, cooked in flowing steam for 12½ minutes at 212° F., and cooled in a spray of cold water. Staff members assisted in picking the crab meat.

Half-pint waxed cartons and half-pound flat tin cans were used as containers for the crab meat. Heat-sealed moisture-vapor-resistant cellophane bags were used to line the cartons, and parchment paper was used to line the tin cans. An equal amount of leg meat and body meat totaling 7 ounces net weight was placed in each container. The cartons were merely closed; the cans were double seamed under 25 inches of vacuum. Note exception (b) below:

Crab meat was packed in the following containers without liquid:

*Chemist, Fishery Technological Laboratory, Division of Commercial Fisheries, Seattle, Wash.

(a) Half-pint, cylindrical (heavily waxed) cartons containing a heat-sealed, moisture-vapor-resistant cellophane bag.

(b) Half-pound, flat tin cans, seamed on the first operation roll only, to simulate the friction-top tin can.

(c) Half-pound, flat tin cans.

Crab meat was packed in the following containers with liquid as indicated:

(d) Half-pound, flat tin cans, product packed in water to cover.

(e) Half-pound, flat tin cans, product packed in 1 percent salt* brine to cover.

(f) Half-pound, flat tin cans, product packed in 2 percent salt* brine to cover.

(g) Half-pound, flat tin cans, product packed in 3 percent salt* brine to cover.

(h) Half-pound, flat tin cans, product packed in 4 percent salt* brine to cover.

All containers were allowed to remain in the sharp freezer at 0° F. for 48 hours. They were then placed in storage at +5° F. for subsequent examination at 3, 6, and 9 months.

EXAMINATION: Two packages of each code were removed from storage and thawed for 1½ hours in tap water at room temperature before being opened. Vacuums ranged from 15 to 19 inches of mercury in the liquid packs and from 21 to 22 inches of mercury in the dry packs.

Samples were judged organoleptically by members of the staff for color and flavor. Tenderness was measured on the tenderometer developed by Shockey, McKee, and Hamm (1944) and originally designed for use in measuring the tenderness of reconstituted dehydrated fish.

Changes in Tenderness: Tenderness is one of the qualities of frozen crab meat most subject to change. It is the quality which lends itself to mechanical measurement on the tenderometer. By use of this instrument, values of tenderness were obtained and recorded in Table 1.

Table 1 - Tenderometer Values of Crab Meat 1/

Sample	Container	Seal	Added Liquid	STORAGE PERIOD AT +5° F.								
				3 months			6 months			9 months		
				Leg	Body	Av.	Leg	Body	Av.	Leg	Body	Av.
a	MSAT Cellophane	2/	-	28	22	25	31	32	31	44	32	38
b	Can	1st Operation roll	-	27	21	23	23	28	25	37	34	35
c	Can	Vacuum	-	13	8	10	12	9	10	17	14	15
d	Can	Vacuum	Water	12	7	9	14	10	12	13	10	11
e	Can	Vacuum	1% brine	10	7	8	12	11	11	16	10	13
f	Can	Vacuum	2% brine	9	7	8	10	7	8	11	8	9
g	Can	Vacuum	3% brine	8	7	7	10	6	8	12	7	9
h	Can	Vacuum	4% brine	8	6	7	9	6	7	11	9	10

1/ Fresh-picked crab meat will yield tenderometer values varying from 10 to 16, depending upon cooking time and other conditions. Freezing and thawing may lower these readings to values varying from 7 to 13.

2/ MSAT = Moisture-vapor-proof, sealable by heat, anchored coating, transparent.

*Salt = sodium chloride, NaCl chemically pure.

The tenderometer readings obtained are relative values. Values of 18 or more might be considered as indicative of a tough product from an organoleptic standpoint. Samples packed in moisture-vapor-resistant cellophane and in tin cans closed by the first operation roll only were too tough to be considered palatable after 3 months' storage. All of the remaining samples which were vacuum-packed in tin remained palatable over the entire period of storage. Body meat indicated a tendency to be more tender than leg meat. Toughness, as determined organoleptically, and the corresponding tenderometer readings increased gradually, from one 3-month examination period to the next, on the basis of readings averaged for leg and body meat.

Unfortunately, initial tenderometer readings were not obtained. However, if the original average tenderometer reading for this crab meat were taken as 10 (usual average for fresh frozen crab meat) then the increase in toughness over the first 3 months' storage period would be 150 percent and 130 percent for samples (a) and (b), respectively, and negligible amounts for the remaining samples. These results indicate that the greatest increase in the percent of toughening of crab meat sealed in moisture-vapor-resistant cellophane bags or friction-top tins occurs during the first 3 months of storage. The total amount of toughening that takes place in the samples not hermetically sealed is in the neighborhood of four or five times the total amount of toughening that takes place in samples hermetically sealed in a partial vacuum. Furthermore, the amount of toughening that does occur in samples not hermetically sealed renders them unpalatable.

Crab meat covered with water or brine of increasing concentration shows a slight tendency toward increased retention of tenderness; however, tenderometer readings become less accurate as they approach the lower end of the scale; so this trend is not clearly defined.

Color and Flavor: The color in the series of samples when examined organoleptically at 3, 6, and 9 months progressed in uniform steps from sample a to b, to c, etc., as follows:

a b c d e f g h →
Considerably faded, moderately faded, somewhat faded, normal color

Flavor in the series of samples when examined organoleptically at 3, 6, and 9 months progressed in uniform steps from sample a to b, to c, etc., as follows:

a b c d e f g h →
Unpalatable haylike flavor, lack of flavor, faint flavor, palatable flavor

Crab meat covered with water or brine shows a definite tendency toward increased retention of color and flavor with increasing concentrations of salt.

Note: These results should not be interpreted as a recommendation for the use of evacuated tin containers in the storage of frozen crab meat. Although such a packaging method would undoubtedly keep the product in an excellent condition over a long period of time, there is danger that if frozen crab meat were packed in ordinary tin cans, consumers or dealers might store the cans at room

temperatures regardless of any printed cautions. Under such conditions, frozen crab meat would defrost and spoil rapidly. When hermetically sealed, defrosted foods possess all of the requirements for the growth of Clostridium botulinum with consequent toxin production. The findings should serve to emphasize the fact that experimental means for retarding the toughening of frozen crab meat do exist.

LITERATURE CITED

SHOCKEY, CHARLES F.; McKEE, LYNNE G.; and HAMM, WILLIAM S.

1944. Instrument for measuring changes in texture of dehydrated fish. Ind. and Eng. Chem., Analytical Ed. 16, 638 pp.

FOOD FREEZING

Because of the need for constant low-temperature refrigeration up to the time of the product's use by the consumer, shortage of refrigerated facilities at any one point blocks expansion in the use of frozen foods. The existence of many millions of outmoded electrical refrigerators with inadequate frozen food storage space presents one of the most important equipment handicaps to expanding use of frozen foods in the home. Many postwar models now going into homes are also lacking in frozen storage space.

Of concern to the fishing industry are the problems growing out of seasonal variations in the production and marketing of fish. High rates of production create a supply in excess of requirements in most markets. Periods of overabundance are followed by scarcities with resultant affect on supply, demand, and price. Relief from these difficulties can come through the provision of adequate freezer and storage capacity in each producing center.

It is expected that there will be a period of adjustment during the early part of 1947 in the fish-freezing industry, when efforts will be made to adjust to peacetime demands. The duration of the shortage in cold-storage space will depend, largely, on the trend in freezing, and warehouses will be crowded until freezer capacity is expanded.

--Fishery Leaflet No. 215

STUDIES ON DETERIORATION OF VITAMIN A IN FISH LIVERS AND LIVER OILS 1/

PART I - LOSS OF VITAMIN A AND STABILITY IN GRAYFISH LIVERS IN STORAGE

By F. B. Sanford,* D. Miyauchi,* and G. I. Jones*

ABSTRACT

Ground grayfish (Squalus suckleyi) liver samples stored from 4 to 7 weeks under three different conditions: room temperature (23°C.), in ice (0°C.), and in frozen storage (-22.5°C.), were tested at varying intervals. Results of these tests showed no significant change in the vitamin A potency. However, with increase in temperature of storage, the free fatty acid content tends to rise, and the vitamin A stability rapidly decreases.

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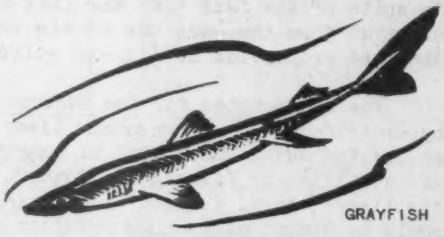
The fish livers from which vitamin A oils are commercially derived are often held for a considerable period of time before being processed. The fishing vessels, in their voyaging for sharks and other fishes rich in vitamin A, range over great distances, and trips of 2, 3, or even 4 weeks' duration are not uncommon. After the livers are landed, a further delay may be encountered before they are processed. Plant facilities are not always adequate to handle the volume of livers brought in at the peak of the season. Economic considerations may also delay the processing of the livers, as, for instance, when they are held for the development of a more favorable market or are shipped to a distant processing plant.



GRAYFISH

Unfortunately, vitamin A is chemically unstable under certain conditions. Knowledge of the effect of storage on the vitamin A content of fish livers is essential, therefore, to the most efficient utilization of this raw material.

In the Pacific Northwest, the grayfish (Squalus suckleyi) is one of the principal sources of vitamin A. The livers from this species are usually stored in 5-gallon cans or 55-gallon drums. The temperature of storage varies widely. Aboard ship, the livers are usually kept iced; on shore, they are ordinarily kept under refrigeration at temperatures from 0° to 20° F. Occasionally, when a boat runs out of ice or refrigeration facilities are crowded, the livers may stand for some time at temperatures considerably above freezing.

An experiment to determine the effect of storage on the vitamin A content of grayfish livers involves a number of practical difficulties. The livers are expensive; a 5-gallon can of them may be worth $16.00 or more. It is difficult to get a representative sample for analysis. There is wide variation in vitamin A potency from one liver to another; and, unless the sampling is carefully controlled, errors in the estimation of the vitamin A content may be large.

To lessen the cost and make uniform sampling easier, the livers can be ground, stirred until homogeneous, and then stored in small containers. It should be

* Chemists, Fishery Technological Laboratory, Division of Commercial Fisheries, Seattle, Wash.

1/ This is the first of a series of articles on this subject. Others will appear in later issues.

understood that this procedure would not be identical with general commercial practice, as livers are not ordinarily ground prior to storage. However, since the grinding exposes a large surface to the air and thus increases the possibility of oxygen absorption, the conditions of such an experiment are, in all probability, more severe than those encountered commercially. Consequently, no greater vitamin A losses would be anticipated in ordinary practice than would be observed in a test of this kind.

In the present study, approximately 30 pounds of grayfish livers were used. The fish had been caught off Cape Beal[2] an estimated 3 days earlier, and the livers were iced during transit to the laboratory. The livers were then passed through a meat grinder, stirred until homogeneous, and filled into pint Mason jars to within ½ to 1 inch of the top. Rubber rings were placed on the jars, and the lids screwed down tightly. The jars were then divided into three groups, one for storage at room temperature (23° C.), a second for storage in ice (0° C.), and a third for frozen storage (-22.5° C.).

Periodically, three jars from each of the three groups were opened for examination. As could be anticipated, the livers stored at room temperature spoiled rapidly and were definitely putrid by the end of the first week. So much gas was generated that a small amount of liver material was forced out of the jars in spite of the fact that the lids were tightly secured. However, the material expelled from the jars was of the same consistency as that inside the jars, so that the proportion of oil and solids inside the jars remained about the same.

The oil samples for the various organoleptic and other tests were separated by centrifugation of the ground liver after it had been mixed with an equal weight of boiling water and heated to coagulate the protein. They were then dehydrated and clarified by filtration through cotton and anhydrous sodium sulfate. With the livers stored at room temperature, a stubborn emulsion was encountered which could be broken only by the addition of salts such as ammonium sulfate to the mixture of water and liver material.

Oil prepared from the liver material that had been stored 4 weeks at room temperature had a slightly putrid odor and taste, but was not necessarily nauseating or repulsive, although its after-taste persisted for about 30 minutes. Visually, the color of this oil was not significantly different from the color of the oil rendered at the start of the test.

In contrast to the liver material held at room temperature, the materials stored in ice at 0° C. and in the refrigerator at -22.5° C. remained in good condition throughout the entire period of the test. When the jar lids were removed, there was only a slight ammoniacal odor.

In addition to being tested organoleptically, the liver material was analyzed for its oil and vitamin A content. The method used was a slight modification of that recommended by the Joint Government and Industry Committee on Vitamin A that met at San Francisco in June 1944. Optical density readings were made on a Beckman quartz spectrophotometer at a wave length of 328 mmu., and the values of $E\ \frac{1\%}{1\ cm.}$ (extinction coefficients) were converted into vitamin A units by multiplication by 2000.

In order to determine the changes in the quality of the oil rendered from the stored livers, analyses were made for free fatty acid, and the vitamin A stability

2/Cape Beal is located on the west coast of Vancouver Island, B. C., Canada.

was estimated. The free fatty acid was determined by the A.O.A.C. VI method,[3] and the vitamin A stability was estimated by the procedure described by Sanford, Harrison, and Stansby.[4]

Results of these experiments appear in Table 1. Since the method of vitamin A analysis is uncertain to the extent of about 2 percent, the fluctuations appearing in the column indicating vitamin A potency are too small to be significant.

Table 1 - Effect of Storage on Ground Grayfish Livers

Item	Storage Period	Amt. of Oil in Livers	Vitamin A Potency of Liver Oil	Free Fatty Acid in Liver Oil	Vitamin A Stability of Liver Oil
	Days	Percent by Weight	U.S.P. Units per Gram	Percent as Oleic Acid	Hrs. to Affect 50% Decomposition by Aeration at 100° C.
Livers stored at room temperature. (18°C. to 27°C., Average = 23°C.)	0	73.52	14,215	0.15	17.55
	7	72.38	14,380	0.48	14.13
	14	72.35	14,288	0.63	7.50
	21	71.53	14,316	0.50	8.72
	28	71.74	14,504	0.68	3.61
Livers stored in ice. (0°C.)	0	73.52	14,215	0.15	17.55
	15	-	-	0.24	12.40
	22	71.22	14,309	0.24	10.83
	29	71.94	14,437	0.23	9.65
	43	72.20	14,350	0.21	13.36
Livers stored in refrigerator. (-28°C. to -20°C., Average = -22.5°C.)	0	73.52	14,215	0.15	17.55
	23	72.41	14,356	0.17	15.76
	49	72.59	14,400	0.14	16.65

Regardless of the type of storage, the amount of vitamin A decomposed was too small to be determined by the analytical methods employed. The possibility existed that a drop in vitamin A potency may have been masked by an increase in extraneous absorption. To check this, the E values for various wave lengths between 300 and 370 mmu. were determined. Ratios of the E values at these various wave lengths to the E value at 328 mmu. (Table 2) indicate that, during the test period, no significant amount of any substance was formed that absorbed light in the region

Table 2 - Optical Density Ratio for Oils Rendered from Ground Grayfish Livers

Item	Storage Period	Optical Density Ratio D_λ/D_{328} for Wave Lengths in mmu. (λ)									
		300	310	320	325	328	330	340	350	360	370
	Days										
Oils rendered from livers stored at room temperature. (18°C. to 27°C., Average = 23°C.)	0	.667	.842	.972	.991	1.000	.980	.806	.570	.352	.180
	7	.622	.872	.959	.997	1.000	.996	.820	.576	.345	.183
	14	.651	.835	.957	1.000	1.000	.989	.815	.572	.355	.181
	21	.649	.849	.958	.998	1.000	.977	.810	.569	.348	.181
	28	.654	.842	.959	1.003	1.000	.984	.812	.569	.354	.181
Oils rendered from livers stored in ice. (0°C.)	0	.667	.842	.972	.991	1.000	.980	.806	.570	.352	.180
	22	.643	.841	.961	.998	1.000	.988	.818	.572	.357	.182
	29	.650	.850	.958	.998	1.000	.976	.816	.571	.355	.181
	42	.652	.839	.956	1.003	1.000	.981	.814	.560	.356	.178
Oils rendered from livers stored in refrigerator. (-28°C. to -20°C., Average = -22.5°C.)	0	.667	.842	.972	.991	1.000	.980	.806	.570	.352	.180
	23	.653	.847	.955	.998	1.000	.978	.813	.560	.346	.182

3/ Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists, Sixth Edition, 501 (1945).

4/ F. B. Sanford, R. W. Harrison, and M. E. Stansby. "A Rapid Test for Vitamin A Stability." Commercial Fisheries Review, March 1946, pp. 16-18. Also F.L. 212.

of the spectrum that was used for estimating vitamin A. Thus, there can be little doubt that the vitamin A analyses reported in Table 1 represent the actual vitamin A values.

The percent of oil recovered from the fresh livers appeared to be somewhat higher than that obtained after the livers had been stored. This is probably an artifact, since the oil assays of the livers stored at room temperature showed no greater changes than did the livers stored on ice. This supports the conclusion arrived at by visual inspection that the ratio of oil to solids remained nearly constant in the jars stored at room temperature despite the previously mentioned loss of putrefying liver material through the seal.

Lowering the temperature of storage appeared to decrease the rate at which free fatty acid[5/] was formed. In no case, however, was the change in free fatty acid large, since even in the oil rendered from the liver material stored at room temperature the increase was only about ½ of 1 percent.

The vitamin A stability[6/] measurements were somewhat erratic. Until further studies have been completed, it would be difficult to determine the exact cause of these variations. Although each stability datum represents the average of duplicate or triplicate measurements, a good proportion of the variation was, no doubt, due to analytical errors, since duplicate measurements deviated one from another by 7.4 percent on the average. However, with the simple method of rendering used, it may well be that the proportions of antioxidants and pro-oxidants extracted differed greatly from one time to another. Variable though the results were, they are sufficiently precise to show clearly that lowering the temperature of storage substantially increased stability. Storage of the livers in ice was a definite improvement over storage at room temperature. The small drop in stability shown during 7 weeks of refrigerated storage was probably within the limits of error of the method of analysis.

In summary, the results of the experiment confirm earlier observations at this laboratory that the vitamin A in grayfish livers is quite stable. The results also indicate that, when these livers are held in well-filled containers with tightly fitting lids, there will be no measurable loss of vitamin A, even if the livers are stored at room temperature for as long as a month. However, other changes taking place in the livers make this temperature of storage definitely unsatisfactory. At room temperature, the livers soon became putrid, and an undesirable odor and taste is imparted to the oil rendered from them. Other deleterious changes also take place. Free fatty acid tends to increase, and vitamin A stability drops rapidly.

5/ The free fatty acid content has long been used as an index of quality, since oils which have been rendered from inferior materials or those which have been carelessly treated usually have a high free fatty acid content. Liver-plant operators have found also that, where the free fatty acids are high, difficulty is encountered in rendering the oil from the livers and that, as a consequence, plant efficiency is lowered.

6/ This stability test is an index of the resistance of the vitamin A contained in an oil toward oxidation. Such information is of importance to the oil buyer as he wants to know not only how much vitamin A he is buying but how well the vitamin will hold up during storage. For example, when a vitamin A oil is mixed with a meal for animal feeding, the oil is spread over an enormous surface under conditions which favor rapid oxidation. Studies already reported in the literature indicate that, under these circumstances, the losses of vitamin A may be both rapid and large. A second aspect of the problem concerns the fate of vitamin A after it has been ingested by the animal. If the vitamin is oxidized before it has been assimilated, the vitamin can then serve no useful purpose.

The more serious of these difficulties can be minimized if the livers are properly iced. Not only is there less formation of free fatty acid and less drop in vitamin A stability; but, over a storage period as long as 6 weeks, the livers are not so apt to become putrid. Where practical, refrigerating the livers at subfreezing temperature is a definite advantage, even if the method cannot be utilized during the entire storage period, since the rate of formation of free fatty acid and the drop in vitamin A stability are greatly decreased as the temperature is lowered.

FATS AND OILS

In the first 6 or 8 months of 1947, particularly in the late spring and summer, supplies of food fats and oils, other than butter, probably will be even smaller than in the corresponding period of 1946. The anticipated output of edible vegetable oils from 1946 crops is about the same as that from crops harvested in 1945. With controls on use of oils and fats in edible products removed in late October 1946, vegetable oils moved into consumption at a substantially faster rate in the last 3 months of 1946 than in the previous year. Factory and warehouse stocks of corn, cottonseed, soybean, and peanut oils on December 31, 1946, totaled only 490 million pounds, 282 million pounds less than a year earlier. There may be some increase in the use of imported oils in food products in 1947. Demand for food fats will remain in excess of supply.

Fish oils will be in very short supply for most of 1947. The California pilchard fishery, which normally contributes approximately one-half of the total fish oil produced in the United States, has suffered the most severe slump in its history.

Production of fish oils during 1946 totaled about 20 million gallons, $4\frac{1}{2}$ million gallons less than the 1945 production and 15.7 million gallons below the 1935-39 average.

--Fishery Leaflet No. 215

SECTIONAL REVIEWS

Chesapeake

MARYLAND: The price drop which so seriously affected the oyster market, after meat became more available, seemed about to be halted early in January as prices to the oysterman improved from $2 or less per bushel to around $3.50. Competitive bidding among dealers was held principally responsible for the increased price. Certain dealers ventured to predict a shortage of oysters.

OYSTER BOAT

Production has been restricted by the continuing effects of the widespread mortality of bay oysters in early 1946. Too much rain is generally agreed upon as the cause, and the beds will probably require about 3 years to recover. Most of these beds are in areas controlled by the State and are opened or closed by the Commissioner of Fisheries as conditions warrant. Dredging by sail power is the principal means of harvesting these oysters.

On a bed recently opened in Kent county, dredgers averaged 125 bushels per vessel per day, but even this is not a record harvest. On another State-controlled bed, lately opened, tongers took as many as 90 bushels per boat (2 men) per day. Dredgers carry crews of three to five men and two dredges. To meet the expenses of stocking the beds with seed oysters or shells or both, the State levies a tax of 20 cents per bushel on oysters taken from controlled areas.

Bay oysters were generally fat and in good condition, but seaside oysters were not. The latter, which come mainly from upper Chincoteague Bay, are in good demand at raw bars. In order to meet the standards of this trade, oysters must be single, regularly shaped, and of pleasing appearance when opened. Consequently, considerable selecting is necessary, and the price increases accordingly. Bar stock from Worcester, Maryland's only seaside county, brought $12 a barrel. So far this season, in view of the poor condition of Worcester oysters, bar stock has been scarce.

In 1943, the State decided to legalize, under certain conditions relating to size and location, the much-discussed crab pot. Now in 1947, a review of the results seems in order. The number of pots licensed has about doubled each year as many crabbers have abandoned trotlines for pots. However, a great deal of trotline crabbing is still practiced in waters where crab pots are prohibited. If a trotline crabber decides to operate pots, he must go to the areas in the open bay where they are permitted, usually some distance from home.

Striped bass, or rock, were fairly plentiful during December. Some were caught in nets throughout the winter. In warmer weather, sportsmen also bring in large numbers. Fishing for rock is one of the mainstays of Maryland's hook-and-line profession. It is possible for hook-and-liners who work at it to catch enough to make a substantial profit. One dealer cited the instance of two men selling him rock over a period of 2 weeks. They fished 4 lines each, baited with locally-caught shrimp, used one boat, and sold their catch for $800.

Eastern Bay is the favorite ground for rock-fishing for sport. During the vacation season, as many as 100 boats a day may be seen there. On good days, boats may average 100 pounds apiece. The shrimp used for bait are not the edible species. They are caught along shore by a man wading with a small push net on rollers. They sell for about $6 per gallon.

South Atlantic

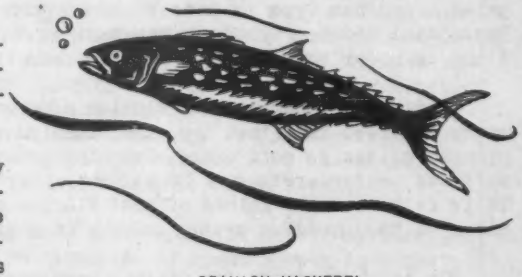
FLORIDA: Fish production during the months of January and February was rather erratic. The West Coast reported landings about normal for this time of year. East Coast ports, on the other hand, reported landings far lighter than usual.

Many reasons have been advanced for the decreased production on the east coast. The consensus points to the unusually long spell of warm weather which prevailed without a break. The short period of cool weather needed to concentrate the fish on the fishing grounds had not appeared.

Unlike most varieties, grouper were a glut on the market with uncut fish in retail markets moderately priced. Fishermen still received ex-vessel prices, approximating wartime prices. Consumers, however, have been able to purchase grouper in retail markets quite reasonably.

Grouper is a fish that is not a profitable fillet item. The yield is only about 33 percent. To this the dealer must add the cost of labor, ice, and packaging, which will run relatively high in this section of the Gulf. This puts grouper fillets almost in the luxury class. It is, therefore, impossible to compete with New England or imported fillets which sell for little more than half the price, in car lots. The result is that practically no fish is packaged in the Gulf area. Many firms were holding large supplies of grouper with little prospect of breaking even.

The large snapper producers are also handicapped. They must sell grouper, as the snapper alone are not sufficent to make a trip pay.



SPANISH MACKEREL

Spanish mackerel has been probably the most reasonable item in retail markets. Although it has an ex-vessel price comparable to grouper, unlike the grouper, Spanish mackerel will fillet out as well as haddock. A few firms have cut some fillets and put them in the freezer. The tendency was, however, away from cutting since most dealers did not want to put that much money in one item on a declining market and the bulk of the mackerel went into the freezer as is; that is, drawn only.

Northern markets did not absorb expected quantities of mackerel and it has never been a big southern seller. A number of the restaurants, however, have featured Spanish mackerel fillets on their regular meals.

Of grave concern to many, in Florida, during this period, was the heavy fish mortality. Although some accounts listed only bottom fish as the principal casual-

ties, sport fish were also affected. Tarpon, black and red drum, speckled trout, in fact, practically all species except grouper, snapper, and other deep water fish, suffered. The heaviest casualties seemed to be among black drum. They were washed ashore in unbelievable numbers.

Several reasons have been advanced for the mortality, all of which centered around warm weather. It was noted, however, that quantities of fish were washed ashore in the vicinity of Naples where neither the water nor the weather was warm during the time that this mortality occurred.

Up to February, the St. John's River run of shad was judged to be about only one-third the normal production. If a good "run" does not appear before shad arrives in the rivers to the north, usually before March, fishermen and dealers are likely to be affected financially. They depend on the early high prices that prevail in northern markets for the bulk of their income from this fishery.

The shrimp fleet, which is about twice the size of the fleet in 1944, experienced some difficulty in making profitable trips. Many trawlers were reported returning to port with only 20 or 30 pounds of shrimp to show for a couple of days of dragging. Profitable operation requires production about 50 times greater.

Crab pots in Florida are replacing trotlines, to a great extent. Their use is not subject to as many restrictions, as in Maryland and Virginia. The number fished by a fisherman is not limited. There are no specifications as to mesh size or locality of use.

The Florida pot, which is referred to as a "trap," bears little resemblence to the patented crab pot of the Chesapeake. It is, in many cases, a slat box made of laths or palmetto stalks. A wire is attached to the inside on which bait is impaled. Another type is made of heavy wire mesh, sturdier than the chicken-wire Chesapeake model. Crabbers who have studied the Chesapeake pot say it will not stand up under the onslaughts of the large, powerful Florida blue crab.

Soft crab propagation in Florida apparently could be the subject for biological study. Dealers know that the exceptional size attained by Florida crabs would bring premium prices as soft crabs. Crabbing grounds like those in the Chesapeake, where soft and peeler crabs may be picked up by dip-netters have not yet been found. It is said that the nature of most Florida crabbing grounds is to offer protective cover to the shedding crabs, making it difficult to find them.

Up to the present, no use has been made of the quantities of crab refuse from crab meat houses. In the Jacksonville area, this refuse amounts to about 2 million pounds annually. One company, however, has ordered dehydrating equipment and plans to go into the production of meal.

Pollution has wiped out oyster production from Fernandina to New Smyrna. Extensive clam beds have suffered, equally, with the oysters. The most extensive destruction has probably been reached at Fernandina, because of the discharge of pulp mill wastes into the Amelia River. Not only were oyster beds wiped out here, but fish, porpoises, and sea turtles, were seen floating, killed from having ventured too close to shore.

Oyster shucking on the East Coast contributes little to the shell and lime industry. The raw material for this operation comes from extensive oyster-shell reefs or deposits found in marshes, along the coast, near Jacksonville. For the privilege of dredging such reefs, the manufacturer pays a royalty per ton of shells removed. The beds, extending to a depth of 60 feet or more, are supposed to have been built up, during several centuries, from natural bars and have no connection with the shell piles left by Indian settlements.

THE MAINE SEA MOSS INDUSTRY

SEA MOSS

"The collecting of Irish moss or carrageen (Chondrus crispus) constitutes the oldest seaweed industry in the United States. For a century it has been harvested and sold, chiefly for making blancmange. More recently, a commercially useful extract, carrageenin, has been prepared from it, to serve as a stabilizer in chocolate milk, salad dressing, soda fountain sirups, cough sirups, toothpaste, hand lotions, cosmetics, paint, beer, and many pharmaceutical products. At present, the range in the uses of sea moss appears to be limited only by human ingenuity.

"Although, according to historical data, it was in 1835 that sea moss was first gathered in Ireland, it was not discovered in this country (at Scituate, Mass.) until 1847. Despite the fact that the American moss was superior to the imported variety, increasing costs gradually made its harvest prohibitive until World War II shut off imported supplies of the gelatinous submarine growth and revived the industry in this country. With the war, plus expanding uses for the moss, came an ever increasing demand for the seaweed. Not only did the industry revive and expand in Massachusetts, but the discovery of prolific beds of moss all along the Maine coast gave impetus to that industry in this State as well.

"The harvesting season for sea moss is from the first of May through the early part of September with the exception of about a week in August, when it blooms. Although the flowering period for moss varies with locale and weather conditions there will be some beds where the moss is later in blooming, so that by careful observation of local conditions, the mosser may continue to rake moss throughout the month. However, areas which are in bloom should not be gathered until the sticky fine green or grayish green growth in the heads of the moss, which characterizes the bloom, has disappeared; either through maturity or as the result of a storm."

--Bulletin of the Department of Sea and Shore Fisheries

TECHNOLOGICAL RESEARCH IN SERVICE LABORATORIES

DECEMBER 1946

Seattle, Wash.

Samples of fish meal, oil, and stickwater from a Minnesota carp-reduction plant were analyzed, and improvements in processing methods were suggested. A similar service was performed for a local producer.

* * *

A local concern was aided in sorting out packages of frozen crab meat, which had been contaminated with fuel oil, from packages which were not contaminated. The contaminated packages were picked out by the difference in their fluorescence under ultra-violet light.

* * *

SEATTLE, WASHINGTON

A sample of the largely discarded part of the viscera of the Dungeness crab, which is commonly called "crab fat," was submitted by the Washington State Department of Fisheries for assay of the oil and vitamin A contents. Despite its fat-like appearance, the sample contained 93.6 percent water and only 0.34 percent oil. This oil contained 24,700 USP units of vitamin A per gram; but, with so little oil, the "crab fat" sample would be worth less than one cent per pound for its vitamin A content on the basis of present prices.

* * *

Pink salmon fillets that had been in frozen storage at 3° F. for three months were cooked and then tested by a taste panel. Better comparison should be obtained at the six-month test; but the following tentative conclusions were reached on the basis of the three-month scores:

1. No antioxidant treatment used was entirely effective in preventing incipient rancidity in the fatty surface flesh.

2. Fillets treated with solutions of N.D.G.A. in either water or cottonseed oil were free from off odor and were slightly preferable to untreated samples.

3. Ascorbic, citric, or benzoic acid did not noticeably improve the action of the N.D.G.A. but did cause off odors.

* * *

A series of steelhead-trout steaks were prepared for testing similar to the above. They were dipped in water or in solutions containing various concentrations of N.D.G.A. and then packaged, frozen, and placed in storage at 5° F. These samples will be periodically compared with controls.

* * *

After four months' storage at -5° F., samples of frozen silver salmon were rated for odor and flavor as follows:

Vacuum packed in tin cans - normal.
Foil wrapped - very slight incipient rancidity.
Cellophane wrapped - incipiently rancid.

* * *

Uncooked king crabs, frozen in the shell, were thawed and cooked. The meat adhered to the shell and was extremely difficult to remove in satisfactory condition.

* * *

In cooperation with university authorities and others, a series of 11 two-hour classes for fishermen and fishing industry employees was planned, under the supervision of the Adult Education Division for evening sessions, at the University of Washington School of Fisheries.

* * *

Further analyses were made on stored lots of livers and liver oils in connection with the studies on vitamin A deterioration.

* * *

The construction of the pilot plant was completed.

Boston, Mass.

At Eastport, Maine, a dehumidifier was installed to treat the smoke being used in the experiments on the electrical smoking of sardines. The dehumidified smoke gave greatly improved results.

College Park, Md.

Nine trial shipments of fish in three types of containers were sent by air from Tampa, Florida, to the College Park laboratory. Duplicates of two of the shipments were sent in advance by railway express so as to arrive on the same day as the air shipments. On arrival, the fish were stored in crushed ice; and, at intervals, samples were cooked and judged by a taste panel. In one case, the fish sent by air were judged to be better than the fish sent by rail, both immediately after arrival and after various periods of storage. In the other case, no difference was found.

* * *

Fillets of Spanish mackerel and gray sea trout that had been in frozen storage in various wrappers for two months showed no appreciable changes. Oysters that

had been frozen for 9 months still had high palatability. Their pH values decreased only slightly during the past 5 months.

* * *

Various basic recipes were tested to determine their suitability for future fish cookery demonstrations.

* * *

A talk on the determination of the nutritive value of protein was given before the District of Columbia section of the Society for Experimental Biology and Medicine.

* * *

Two lecture demonstrations and one talk on fish cookery were presented at Hunter College, New York City.

* * *

Fifty-one extracts of Alaska clams were assayed for mytilotoxine.

* * *

Twenty-four samples of mud and 192 samples of water from Narragansett Bay were gathered with the cooperation of the Rhode Island State Patrol and examined bacteriologically in the mobile laboratory while it was stationed at Wickford, Rhode Island.

Ketchikan, Alaska

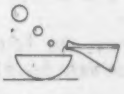
With the cooperation of the Coast Guard, the Alaska Game Commission, and the Alaska Department of Health, clam samples, to be used for mytilotoxine assays, were collected from beaches in the following areas:

Upper St. John the Baptist Bay
St. John the Baptist Bay
Leo's Anchorage
Emmon's Island
Nakwasina Passage
Goddard Hot Springs
Krestoff Sound
Halibut Point

Petersburg

Mayaguez, P. R.

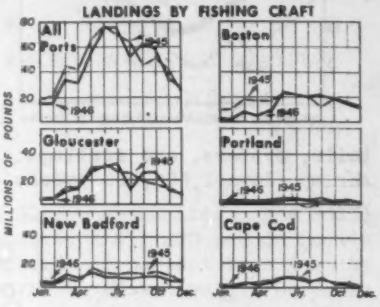
In cooperation with the Commissioner of Agriculture and Commerce, surveys were planned to determine the potentialities of the fresh water fisheries and the possibilities of establishing commercial fish ponds in Puerto Rico.



FRESH AND FROZEN FISH

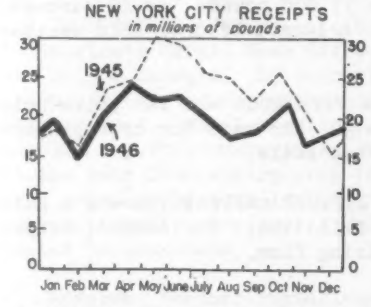
New England

LANDINGS DURING DECEMBER: Landings by fishing craft during December at the ports of Boston, Gloucester, and New Bedford, Mass., Provincetown, other ports on Cape Cod, and Portland, Me., amounted to 29,428,000 pounds, valued at $2,025,900. This was an increase of 21 percent in the volume compared with December 1945. Total landings at these ports during 1946 amounted to 543,026,000 pounds, valued at $40,775,900--a decline of 4.5 percent compared with the 1945 landings, according to Current Fishery Statistics No. 319. Six species accounted for 85 percent of the landings at the above ports during 1946. These were rosefish, 157.9 million pounds; haddock, 126.9 million pounds; cod, 71.7 million pounds; mackerel, 37.3 million pounds, pollock, 37.1 million pounds; and whiting, 32.9 million pounds.



Middle Atlantic

NEW YORK CITY ARRIVALS: Landings and receipts of fishery products in New York during December totaled 17,699,000 pounds, an increase of 5 percent as compared with November and an increase of 11 percent over December 1945 according to the Service's local Market News Office. Leading items were groundfish, hard clams, oysters, scallops, and shrimp. During December, southern species, such as Spanish mackerel, king mackerel, and bluefish, appeared on the market. Shipments of Spanish mackerel were somewhat curtailed due to the exceptional supply of fresh Boston mackerel available to buyers. Boston mackerel receipts, mostly from Long Island and New Jersey, totaled over 314,000 pounds, as compared with less than 15,000 pounds in December 1945 and 1944. Demand was slow throughout December except for eels, squid, pulpi, sepia, and some other shellfish varieties during the Christmas holidays.



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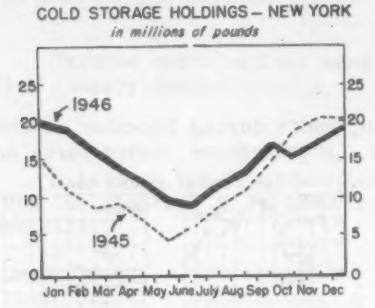
NEW YORK CITY COLD STORAGE HOLDINGS: Cold storage holdings of frozen fishery products, in the metropolitan New York area, totaled 19,168,000 pounds on January 1, an increase of 11 percent over the holdings on December 1, according to the Service's Market News Office in New York. Gains in cod fillets, sablefish, salmon, swordfish, cisco, oysters, and shrimp were the chief reasons for the increase. The principal gain was in cod fillets, due to recent imports.



Compared with January 1, 1946, the holdings declined 4 percent. Decreases in mackerel, salmon, whiting, cisco, whitefish, and shrimp more than offset increases in cod fillets, halibut, swordfish, sturgeon and spoonbill catfish, lobster tails, oysters, and scallops. The greatest declines occurred in mackerel and shrimp, down 1,600,000 pounds and 800,000 pounds respectively, compared with a year ago.

Chesapeake

PRODUCTION: Landings of fish in the Hampton Roads area during December reached 1,438,000 pounds, over double the November production, according to the Service's local Market News Office. Other Chesapeake areas and the Ocean City, Md., and Beaufort, N. C., areas showed a decided decline in production. The increase in the Hampton Roads area was due to greater activity of the trawler fleet operating off the Virginia and Carolina coasts. Southern trawlers, which operated off the New England coast during the summer months, were all back in local waters.

Production of fresh picked crab meat in the Virginia-Maryland areas again showed a drop under the previous month, this time 33,000 pounds, or 20 percent. Dealers credit the low production to warm weather. A long period of cold weather usually causes the crabs to settle to the bottom.

The demand for crab meat during December was very good and the price held up well. Fishermen received $10 per barrel for crabs. The rate for crab pickers was 15 cents per pound, with plenty available at that scale.

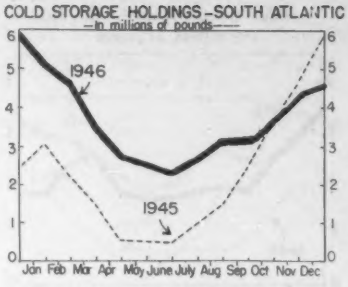
The production of shucked oysters, totaling 287,072 gallons, showed a gain of 12 percent over November. All plants operated full time. The demand, helped by the Christmas trade, was good with prices remaining firm.

South Atlantic

COLD STORAGE: Holdings of fishery products on January 1 in the five major cold storage warehouses in the South Atlantic States totaled 4,574,000 pounds, an increase of 9 percent over December 1, but 1,256,000 pounds, or 28 percent less than on January 1, 1946, according to the Service's Market News Office at Jacksonville.

The leading items were mullet, groundfish fillets, shrimp, whiting and king whiting, Spanish mackerel, catfish and bullheads, scup, and spiny lobster.

Fish stocks increased 365,000 pounds, due mainly to greater stocks of mullet, red drum (redfish), grouper, halibut, pompano, red snapper, salmon, sea trout, and Spanish mackerel. The increase of 122,000 pounds in shellfish stocks was due to gains in holdings of crabs and crab meat, scallops, shrimp, and spiny lobster. Shrimp holdings, however, were under one-half those for a year earlier.



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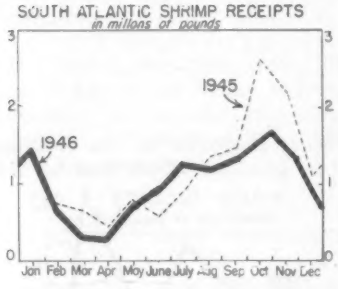
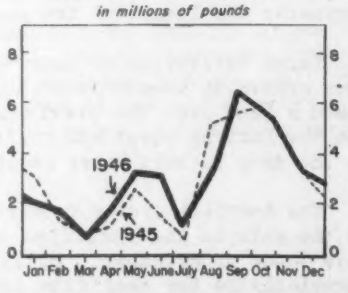


PRODUCTION: Shrimp production in the South Atlantic States amounted to 737,000 pounds (heads off) during December, 41 percent less than in November and 33 percent less than in December 1945, according to the Service's Market News Office at Jacksonville.

The decreased production was due largely to unusually warm weather and the very few landings made during the holiday period.

Gulf

PRODUCTION: Shrimp landings in the Gulf States in December, as reported to the Service's Market News Office in New Orleans, were 22,500 barrels, 22 percent less than the November total, but approximately the same as for December 1945. Total landings during 1946 were less than 2 percent under those in 1945. Throughout the year, less shrimp were landed in Mississippi and Alabama than in 1945, while production was considerably greater in Texas and slightly greater in Louisiana.



Adverse weather curtailed shrimp trawling during the first week and the last 10 days of December. The closed season for taking shrimp in inside waters of Louisiana became effective December 16 and will extend through March 15.

The volume of shrimp reported used for canning during December was 8 percent greater than in December 1945, but slightly over twice as much shrimp was utilized for canning in 1946 as during the previous year.

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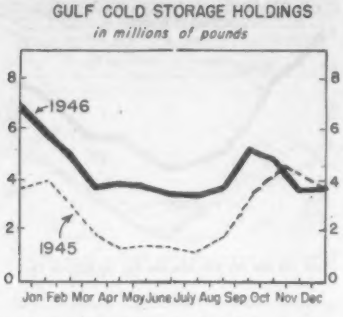
COLD STORAGE: Eleven cold storage warehouses in the Gulf States held 3,629,000 pounds of shrimp on January 2, 4 percent more than 4 weeks previous, and approximately the same amount as on January 3, 1946, according to the Service's Market News Office at New Orleans.

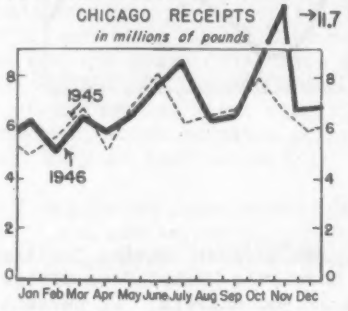


Holdings of frozen cooked and peeled shrimp amounted to 128,000 pounds, the "in" movement exceeding withdrawals during the previous 4 weeks by 27,000 pounds.

Salt-water fish holdings on January 2 were 2,089,000 pounds, 9 percent greater than 4 weeks earlier. Mullet, rosefish, and cod fillets, whiting and king whiting, red snapper, and sea trout accounted for 994,000 pounds of the total.

Great Lakes

CHICAGO RECEIPTS: Receipts of fresh and frozen fishery products in the Chicago wholesale market during December amounted to 6,759,000 pounds, according to the Service's Market News Office in that city. They represented an increase of 2 percent over those of the previous month and an increase of 14 percent over December 1945. Fresh water varieties increased 26 percent over the November total, while salt water varieties decreased 25 percent in arrivals. Shellfish and related items increased 12 percent during the same period.



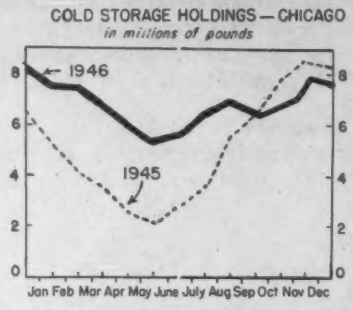
Deliveries during the month were erratic; at times, heavy arrivals indicated a month of heavy production; and at other times, arrivals approximated the lowest of the year.

Large deliveries of chubs were the outstanding feature of the December fresh water arrivals; however, every important item excepting lake trout and lake herring showed a gain over the previous month. Light deliveries of halibut and salmon from the Pacific coast and fillets from the east coast were chiefly responsible for the drop in salt water receipts.

The heaviest oyster receipts of the current season were chiefly responsible for the gain in the shellfish section. Shrimp deliveries were only 2 percent above those of November. Spiny lobster tails, chiefly from South Africa, added appreciably to the shellfish total. Scallop arrivals were comparable with the previous month. Hard clams gained over November receipts while lobster deliveries were little more than half of the previous month.

Throughout the month, even considering the Christmas and New Year holidays, the demand for fishery products kept pace nicely with the supply. Toward the latter part of the month, there were indications that the demand would exceed the supply and this was borne out by accelerated withdrawals from cold storage to augment the exceptionally light arrivals, due to inclement weather in the Great Lakes area.

CHICAGO COLD-STORAGE HOLDINGS: Total holdings of fishery products in Chicago cold-storage warehouses on January 2, 1947, amounted to 7,640,000 pounds. This represented a decline of 3 percent compared with stocks held on December 5, 1946, and was 9 percent below holdings on January 3, 1946, according to the Service's local Market News Office.



Withdrawals during the month were evenly divided between fresh-water and salt-water items. Shellfish remained fairly constant. Dealers predicted a steady withdrawal of cold-storage holdings for the next few months unless fresh-water production regains some of the volume lost during the last two weeks of December. During that time, demand for fishery products comfortably absorbed available supplies but with the predicted increase of consumption, cold storage withdrawals will be necessary to provide supplies.

During December, very little of the frozen arrivals from the Pacific and the east coast found their way into cold-storage warehouses. Most of the deliveries were made to the dealers' storage rooms to be sold from there as readily available supplies. It seemed that dealers were procuring only sufficient supplies for their current needs.

The combined volume of frozen fillets was the most important item of all, with holdings of frozen rosefish fillets being the most important of all salt-water varieties. Decreased shipments of all fillets during the latter part of December, however, may soon deplete these stocks. Other important items in cold storage during December were whitefish, chubs, and lake trout. Salt-water items of importance were the usual halibut, salmon, sablefish, and whiting.

Shrimp, as usual, leads all shellfish holdings. The chief reason for the slight decrease in shrimp holdings during the holidays, the usual season for greater shrimp withdrawals, was the arrival of fresh shrimp in volume. Forty percent of December shrimp receipts were fresh shrimp.

A very disinterested situation regarding frozen fishery products existed on the Chicago wholesale market. This was particularly true of frozen halibut and salmon. The probable reason, in the case of halibut at least, was the small differential between wholesale and retail prices, halibut at present commanding an average price of 38 cents wholesale, while retail prices range from 41 to 44 cents.

Pacific

LANDINGS IN SOUTHERN CALIFORNIA: Landings in the San Pedro-Santa Monica area during December amounted to 2,325,000 pounds of fresh fish, an increase of 25 percent over November, according to the Service's Market News Office in San Pedro, despite extremely light landings after December 15 due to the approaching holidays and the limited demand resulting from a threatened butchers' strike.

A sizable increase in the landings of mackerel, 1,708,000 pounds, as compared with 797,000 pounds in November, was utilized mainly for canning. Landings of

barracuda, California halibut, sardines, white sea bass, smelt, and yellowtail decreased.

San Diego landings increased 20 percent in December, 357,000 pounds as compared with 283,000 pounds in November. Barracuda, black sea bass, bonito, skipjack, and yellowfin showed sizable increases, while landings of California halibut, mackerel, sardines, rock bass, and rockfish decreased.

Newport Beach landings, totaling 279,000 pounds, were 75 percent greater than during November. The most notable increases occurred in landings of barracuda, mackerel, sardines, rockfish, spiny lobster, and bonito.

United States

FISHERY PRODUCTION IN 1946: Although the 1946 fish production of 4.4 billion pounds was not far below average in volume, the year was marked by extremes of success or failure almost without parallel in the history of the fisheries, according to an announcement by the Fish and Wildlife Service.

The menhaden, an Atlantic coast fish used chiefly in the manufacture of fish meal and oil, became the major item in the catch, replacing the Pacific pilchard or sardine, which experienced the worst season in its history and which has supported the Nation's largest fishery for the past 12 years. Rosefish and tuna exceeded all previous production records; the salmon pack was the smallest since 1927.

In terms of pounds landed, the leading fisheries last year were menhaden, pilchard, salmon, tuna, Alaska herring, and rosefish. These six accounted for more than half of the total production.

As reported, the catch of menhaden was approximately 950,000,000 pounds, compared with 759,000,000 pounds in 1945 and 686,000,000 in 1944. Present centers of the menhaden industry are Lewes, Del.; Reedville, Va.; Port Monmouth, N. J.; Beaufort and Morehead City, N. C.; and Fernandina, Fla.

After maintaining a production averaging close to a billion pounds during the past decade, the pilchard fishery landed only 516,000,000 pounds in 1946. This was only about half the quantity taken the previous year. Pilchards were notably scarce in the waters of northern and central California, ordinarily the center of a busy fishery. In 1946, most of the pilchard boats that usually fish out of San Francisco and Monterey either turned to other types of fishing or moved to other ports. Almost the entire 1946 catch of pilchards was made off southern California.

Salmon was another Pacific coast fishery that fell far below normal yields. The pack of 4,430,000 cases, by canneries in the United States and Alaska, was the smallest since 1927. In 1945, also a poor year, 4,908,240 cases of salmon were packed.

Although the northern albacore fishery was almost a complete failure, tuna landings in California were so large that this industry set a new production record in 1946. Complete figures for the year are not yet available, but the pack for the first 11 months was within a few thousand cases of 1945's record pack of 4,531,565 cases and the year's total was certain to reach a considerably higher figure.

Alaska herring, which along with menhaden and pilchard, supplies the raw materials for the fish meal and fish oil industries, continued the increase in productivity begun several years ago. From 113 million pounds in 1944 and 136,346,400 in 1945, the catch of herring in the Territory rose to approximately 190 million pounds last year. Practically the entire catch of this fishery is converted into oil and meal.

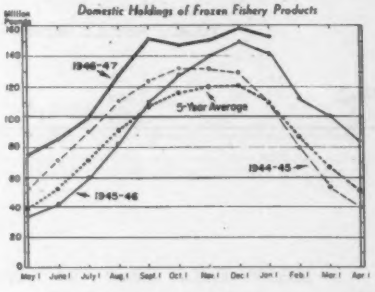
Although the New England fisheries as a whole were slightly less productive in 1946 than in 1945, the major species in the catch--rosefish--made a gain of 38 percent compared with the previous year. Only a little more than a decade ago, rosefish was a little used and almost unknown species; in 1946, landings totaled 180,000,000 pounds, or about a quarter of the total New England fish catch.

Landings of all species at the principal New England ports totaled 698,000,000 pounds, compared with 713,000,000 in 1945.

On the Pacific coast, landings of salmon, halibut, flounders, and miscellaneous species at Seattle totaled about 55 million pounds in 1946, a decline of about 5 million pounds from the 1945 figure.

* * * * *

COLD-STORAGE FREEZINGS AND HOLDINGS: Stocks of frozen fish and shellfish declined 5,633,000 pounds during December, and on January 1 totaled 152,853,000 pounds. This was 9 percent above holdings on January 1, 1946, and 40 percent above the 5-year average for this date. Freezings of fishery products in domestic cold-storage plants totaled 12,575,000 pounds during December compared with 14,591,000 pounds in the corresponding month of 1945, according to Current Fishery Statistics No. 313.



Stocks of frozen fishery products were held in above-average quantities throughout 1946. On December 1, holdings reached the highest point in history when firms reporting thier activities to the Fish and Wildlife Service held 158 million pounds of frozen fish and shellfish. During 1946, 280 million pounds of fishery products were frozen in these plants, 6 million pounds less than in 1945, according to Current Fishery Statistics No. 318.

CANNED AND CURED FISH

Pilchard

PILCHARD PACK: Pilchard (California sardine) landings totaled 48,298 tons during December 1946, according to reports of the California Sardine Products Institute and the California Division of Fish and Game. This resulted in a canned pack of 677,240 actual cases from November 29, 1946 to January 2, 1947. The canned production for the 1946-47 season to January 2 continued to lag behind the 1945-46 season with only 2,474,979 cases packed. The canned production from December 2-29, 1945, amounted to 329,663 cases.

California Sardine Landings, Canned Pack and Byproducts

Item	Unit	MONTH 1946 December	MONTH 1945 December	SEASON 1946-47 Aug.-Dec.	SEASON 1945-46 Aug.-Dec.
Landings	Tons	48,298	31,731	206,689	351,919
		Nov.29,1946-Jan.2,1947	Dec.2-29	Aug.1-Jan.2	Aug.1-Jan.5
Canned	1 lb.ovals-48 per case	178,392	77,884	557,024	1,020,066
	1 lb.talls-48 per case	475,285	241,907	1,820,997	2,079,832
	½ lb.fillets-48 per case	686	-	8,492	-
	½ lb.round-96 per case	8,829	9,228	34,253	43,848
	Unclassified	14,048	644	54,213	91,605
	TOTAL, Actual Cases	677,240	329,663	2,474,979	3,235,351
		December	December	Aug.-Dec.	Aug.-Dec.
Meal	Tons	6,850	5,086	28,034	50,798
Oil	Gallons	682,378	609,112	4,005,950	10,805,320

Shrimp

SHRIMP PACK: For the first time since the shrimp canning season started, the pack of 16,063 standard cases, during December 1946, was only slightly higher than that for the corresponding month in 1945, according to reports to the Food and Drug Administration from plants served by its Seafood Inspection Service. Each prior month of the 1946 season has been double or better the production of its counter-part in 1945.

The season's total, amounting to 233,416 standard cases represents a 100 percent increase over 1945. Despite this comparatively high figure, it is only 80 percent of the 3-year average.

Wet and Dry Pack Shrimp in all Sizes in Tin and Glass--Standard Cases*

MONTH 1946 Dec.1-28	MONTH 1945 Dec.2-22	SEASON 1946-47 July 1-Dec.28	SEASON 1945-46 July 1-Dec.22	3-yr.average July 1-Dec.25
16,063	14,791	233,416	116,107	292,752

*All figures on basis of new standard case--48 No. 1 cans with 7 oz. per can in the wet pack and 6½ oz. per can in the dry pack.

Tuna and Mackerel

TUNA AND MACKEREL PACK: The pack of canned tuna by California canners during December amounted to 436,791 standard cases, an increase of 127 percent over the November pack and 59 percent over that of December 1945, according to information released by the California Division of Fish and Game. Yellowfin tuna alone accounted for 69 percent of the December production. The total tuna pack for the 12 months of 1946--4,568,982 cases--was 29 percent above that of the year 1945. Yellowfin tuna, which has been highest in production each month, made up 48 percent of the year's pack.

The December mackerel pack of 286,525 standard cases was 132 percent higher than November and 97 percent more than December 1945. The total 1946 pack--710,228 cases--was 12 percent above 1945.

California Pack of Tuna and Mackerel--Standard Cases*

Item	December 1946	November 1946	December 1945	Twelve mos. ending with Dec.-- 1946	1945
	Cases	Cases	Cases	Cases	Cases
Tuna:					
Albacore	20	3,466	28	385,682	473,652
Bonito	17,544	9,713	2,668	110,862	49,379
Bluefin	-	354	1	313,547	265,052
Striped	35,487	18,000	65,153	630,882	537,026
Yellowfin	303,558	143,300	177,906	2,183,323	1,457,630
Yellowtail	1,680	2,521	2,396	44,734	16,203
Flakes	78,502	15,039	26,175	899,952	731,518
Tonno style	-	-	-	-	16,198
Total	436,791	192,393	274,327	4,568,982	3,546,658
Mackerel	286,525	123,375	145,153	710,228	635,889

*Standard cases of tuna represent cases of 48 7-ounce cans, while those of mackerel represent cases of 48 1-pound cans.

FISH

Slightly larger supplies of fish are expected to be available for civilian consumption in 1947. However, they are not expected to reach prewar proportions until 1948, when canned fish supplies should return to normal. Expanded fishing fleets and favorable prices during 1946 added to the supply of fresh and frozen fish available for civilian consumption. Large supplies of frozen fish were available throughout the year with a carry-over on January 1 of 153 million pounds, 13 million pounds greater than that of January 1, 1946.

Consumption leveled off in the last 2 months of 1946 as the supplies of other foods increased and the demand for fish declined seasonally. Wholesale and retail prices evidenced some weakness at year's end. Present prospects indicate a continued high level of fishery operations in 1947, even if prices decline somewhat.

--Fishery Leaflet No. 215

FISHERY BYPRODUCTS

Vitamin A

STOCKS AND PRODUCTION: Stocks of vitamin A in fish-liver oil on November 1 were reported at 50.2 trillion units, an increase of 3 percent above stocks held on the first of the previous month and 5 percent higher than those of November 1, 1945.

Production of vitamin A during October totaled 4.5 trillion units compared with 5.9 trillion units produced during October 1945. Total production during the first 10 months of 1946 amounted to 50.3 trillion units compared with 52.3 trillion units produced during the corresponding period of 1945.

Receipts of livers during October totaled 2,014,000 pounds, containing about 4.2 trillion units of vitamin A. During October 1945, 902,000 pounds of livers, having a vitamin A content of 3.8 trillion units, were received, according to Current Fishery Statistics No. 314.

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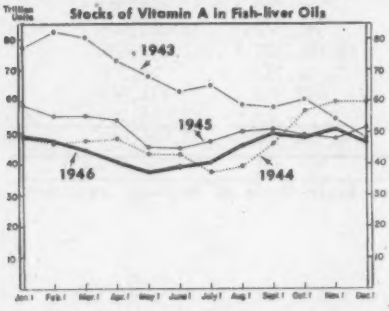
STOCKS AND PRODUCTION: Stocks of vitamin A in fish-liver oil on December 1 were reported at 46.9 trillion units, a decrease of 7 percent under stocks held on November 1 and 10 percent less than those of December 1, 1945.

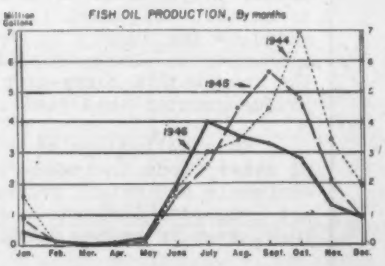


Production of vitamin A during November totaled 2.7 trillion units compared with 5.1 trillion units produced during November 1945. Total production during the first 11 months of 1946 amounted to 53.0 trillion units compared with 57.4 trillion units produced during the similar period of 1945.

Receipts of livers during November totaled 1,675,000 pounds, containing about 5.5 trillion units of vitamin A. During November 1945, 1,111,000 pounds of livers, having a vitamin A content of 4.2 trillion units, were received. according to Current Fishery Statistics No. 323.

Oil and Meal

PRODUCTION: The domestic production of fish scrap and meal, and fish oils was far below normal in 1946 because of the failure of the pilchard (sardine) fishery in the San Francisco and Monterey districts of California. Landings of pilchards in these districts amounted to only 36,555 tons in 1946, compared with 246,074 tons in 1945. Fortunately, the menhaden fishery yielded the largest catch in history, and the Alaska herring catch was considerably above the average for recent years. The production of menhaden and herring scrap and meal in 1946 was 16,000 tons great-



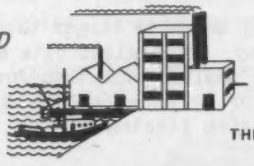
er than in 1945, and the yield of oil increased over 2.5 million gallons, according to Current Fishery Statistics No. 321.

It is estimated that the total yield of fish scrap and meal during 1946, including the production of firms that do not report their operations monthly, amounted to about 186,000 tons, compared with 200,675 tons in 1945 and a 1935-39 average of 221,000 tons. The production of fish oils in 1946, including fish liver oils, is estimated at 20 million gallons, compared with 24.5 million gallons in 1945 and a 1935-39 average of 35.7 million gallons.

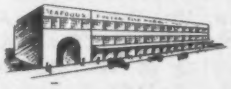
Estimated Value of Fish and Fishery Products at PRODUCTION, PROCESSING, and DISTRIBUTION Levels* 1945

THE *ORIGINAL* VALUE OF FISH AND SHELLFISH AS TAKEN FROM THE WATERS WAS **$230,941,000**

WHEN *PROCESSED*



THE VALUE WAS **$450,335,000**



AFTER *WHOLESALE* DISTRIBUTION THE VALUE WAS **$587,283,000**

AND WHEN *RETAILED* TO THE CONSUMER

THE VALUE WAS **$757,025,000**

* Based on statistical data obtained by Fish and Wildlife Service and Federal Trade Commission

12080

OTHER FISHERY NOTES

Annual Report of the Secretary of the Interior, 1946

This report highlights some of the problems of natural resources management and development which face the United States. Some of these problems require immediate action; others must be met in the next few years; still others are of long-range significance both to the National economy and to the National security. All of them are responsibilities of the Department of the Interior.

This report is on sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for $1.00.

Annual Report of the Fish and Wildlife Service, 1946

The annual report of Director Albert M. Day, of the Fish and Wildlife Service, to the Secretary of the Interior, J. A. Krug, was released on January 10. Part of the report dealt with the commercial fisheries.

Haddock and rosefish, mainstays of the New England fisheries and of the fresh fish markets throughout much of the country, are both becoming scarcer, biologists of the Fish and Wildlife Service believe. Mr. Day reported that, on Georges Bank where the present haddock fishery is centered, a series of poor spawning seasons had affected the productiveness of this fishery. This failure of adequate numbers of young haddock to grow up is due, biologists believe, to lack of food. The ocean bottom in this area probably is not producing enough food for the present population of haddock.

As for rosefish, although the total catch is larger than ever, the individual boats are making smaller catches per day. Biologists cite another warning of decline; the landings are made up of much smaller fish than formerly. Rosefish grow only half an inch a year and take 10 or 12 years to reach maturity. Thus, the fishery is easily injured by too intensive fishing.

Service technologists are finding new ways of promoting more efficient handling and utilization of the products of the commercial fisheries, Mr. Day said. Among recent studies he cited tests which revealed DDT as an extremely efficient insecticide in and around fish processing plants; the testing of containers and wrappings suitable for air transportation of live lobsters, shellfish, and fresh fish; and studies on the sources of vitamin A oils.

Research chemists of the Service found that the quantity and quality of vitamin A oil contained in the livers of the dogfish shark, depend on the size and age of the fish. Processing of livers from dogfish less than 30 inches long was found to be uneconomical and wasteful. These findings have been adopted by shark fishermen, who now concentrate on the larger dogfish.

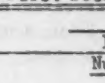
Additions to the Fleet of U.S. Fishing Vessels

A total of 64 vessels received their first documents as fishing craft during January 1947, compared with 42 in the same month of 1946, according to information released by the Bureau of Customs. The South Atlantic and Gulf States led with 25 vessels documented during the month, followed by the Pacific Coast States with 15 vessels.

Vessels Obtaining Their First Documents as Fishing Craft

Section	January		Twelve Months
	1947	1946	1946
	Number	Number	Number
New England	3	3	86
Middle Atlantic	5	2	74
Chesapeake Bay	6	1	71
South Atlantic and Gulf	25	17	351
Pacific Coast	15	12	375
Great Lakes	6	5	76
Alaska	-	-	19
Hawaii	3	-	17
Unknown	1	2	16
Total	64	42	1,085

Note: Vessels documented by the Bureau of the Customs are craft of 5 net tons and over.



Army Fish Purchases

Purchases by the Army's Quartermaster Corps' twelve market centers during January totaled 1,127,192 pounds. Expectations now are for purchases to continue at about 1 million pounds per month, due primarily to the fact that more soldiers are eating in garrison messes than has heretofore been the case.

Purchases during January 1946 amounted to 4,442,020 pounds. The number of men in the Army at that time was much greater than during January 1947.

Fisheries of the Philippines

"Fisheries of the Philippines," a digest of reports submitted by G. L. Kesteven, Fisheries Expert, United Nations Relief and Rehabilitation Administration, has been published by the Industrial Reference Service, U. S. Department of Commerce.

A copy of the report can be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., or any field office of the Department of Commerce. The price is 5 cents.

FAO Fisheries Division

The Food and Agriculture Organization forwarded to Member governments on February 5 a Progress Report and Summary of 1947 Program. That portion relating to the Fisheries Division which is directed by Dr. Finn follows:

"In accordance with the recommendations of the Standing Advisory Committee on Fisheries, which held its first meeting at Bergen in August 1946, and of the second session of the Conference, the work of the Division, which is responsible for all FAO activities relating to fish and fisheries, will be divided amongst three branches: Fishery Economics, Fishery Biology, and Fishery Technology.

"Fishery Economics Branch will be concerned with the equilibrium of production, distribution, and consumption of fish and with economic efficiency within the limits of fishery activities. The economic relationship of fish with food in general is a responsibility of the Economics Division. The work of the branch will initially be divided into three parts:

"(a) Statistics, including the development of common conversion factors and of methodology in the less advanced countries, as well as the collection and collation (in collaboration with Statistics Division) of statistical material in its present form;

"(b) Production and consumption studies, undertaken in cooperation with governments;

"(c) International trade, including studies in the significance of fishery products in international trade and the effect of limiting factors.

"The work of Fishery Biology Branch will be divided into (a) marine biology and (b) fresh water biology, and will ultimately cover fish cultural methods, hydrography, oceanography, and meteorology.

"Fishery Technology Branch will initially include the following subdivisions:

"(a) Fishing methods;

"(b) Fish processing;

"(c) Fishery by-products;

"(d) Fishery engineering, including the application of engineering science both to the catching, processing, transport, storage and distribution of fish and to river and lake management.

The branch will no doubt be called on to provide governments with technical advice, either through the services of its own staff or through arranging for the loan of experts by one government to another. This will be facilitated by compilation of a world directory of fishery experts.

"The work of the Division in assembling recorded knowledge, assisting in its dissemination, determining the gaps in existing knowledge, stimulating measures to fill the gaps and making recommendations for action will depend for its success on liaison with government departments and other national and international organizations. Full advantage will be taken of facilities provided by national FAO committees and regional offices.

"Steps have already been taken to develop cooperation. Mr. P. D. H. Dunn, Fisheries Secretary for England and Wales, who has been closely associated with the work of FAO since its inception, has been appointed as advisor to the Fisheries Subcommittee of the Emergency Economic Committee for Europe. The Director of the Division was present at a meeting of the International Council for the Exploration of the Sea held at Stockholm in August 1946 and made arrangements with the Chairman and the Secretary-General of the Council for coordination of its work with that of FAO. The Director also attended at Bergen in September an international meeting of the salt fish trade, which is seeking to form an international association with objects that are in accordance with the aims of FAO. He also represented FAO at the International Whaling Conference in Washington in November. Measures for continuance of the work of the Fisheries Rehabilitation Division of UNRRA are under discussion.

"Arrangements are contemplated for members of the staff of the Division to visit certain countries in order to assist in developing latent fishing resources. Plans are also under way for a world fishery census in 1950, and a start has been made by the Economics Branch in making special studies of fish products in relation to commodity arrangements."

Report of the FAO Preparatory Commission on World Food Proposals

The FAO Preparatory Commission on World Food Proposals, established by the FAO Conference at Copenhagen in September 1946,[1] met in Washington on October 28. It concluded its work on January 24 with a report[2] to the Director-General of FAO for circulation to governments and United Nations agencies. The report included recommendations regarding certain commodities. Those relating to fish follow:

178. The annual aggregate catch of fish has been estimated at approximately 40,000 million pounds, two-thirds of which is utilized for food. This amount yields 10,500 million pounds of food products as consumed. More than 20 percent of this world aggregate enters into international trade, including such products as salted fish, canned fish, fish meal, fish oils, and vitamin products, frozen fish assuming a lesser position but one of growing importance.

179. Fish as a nutritive protein is of great importance. It is basic in the diet of certain peoples, and constitutes an important part of the food intake of others. Ninety-eight percent of the recorded catch is yielded by the Northern Hemisphere, while much of it is consumed in the Southern Hemisphere.

180. The production of fisheries' products is important to the economy of many countries and vital to some of them. A measure of its importance can be had by examining the per caput production. For Iceland this is 6,223 pounds; for Newfoundland, 1,525 pounds; for Norway, 680 pounds; Japan, 111 pounds; and Canada, 109 pounds. This underestimates the importance of fishing to particular groups in these countries.

181. Of the products entering into international trade one of the most troublesome is salted fish, particularly salted cod and related species. Salted fish is a low-priced concentrated protein food containing sodium chloride, and is suitable and necessary to the diet of people who live in hot countries. Its consumption forms part of a

1/ Commercial Fisheries Review, November 1946 - Supplement, "The FAO Conference at Copenhagen and the Fisheries Outlook in Some European Countries," pp. 1-27.
2/ Report of the FAO Preparatory Commission on World Food Proposals. FAO. Washington, February 1947.

long-established dietary pattern and it is unlikely that its place will be taken by alternative foodstuffs. Examples of such countries will be found in the Caribbean area, in South America, and in South Africa. Other types of cured fish find wide acceptance in countries of temperate climate such as France, the Iberian Peninsula, the Mediterranean, and to a lesser extent, the United States of America. There are certain other countries where considerable potential demand exists because salted fish furnishes a cheap source of high-class protein.

182. Since 1920, the price for salted fish declined steadily until the outbreak of World War II and the decline showed no recovery from the depression year of 1932. This was particularly serious for such countries as Newfoundland, Norway, Iceland, and the Faroes, since the economy of these countries was largely tied up with salted fish. The decline was not accompanied by a diminution of total production; in some areas there was a tendency towards an increase in production in order to keep up income. The low prices failed to support the primary producer and it became necessary for the governments of most of the producing countries to support their fishermen by subsidies.

183. When World War II caused a scarcity owing to the disappearance of the production of Norway and the shift in production to other countries, prices for salted fish increased to a point where production subsidies were no longer needed. This made it necessary for certain importing countries to subsidize consumption, while other countries passed along the increases to the consumer.

184. The history of salted fish marketing during the interwar period was marked by strong competition and rivalry between producing countries. There existed many barriers to the free flow of trade in the form of quota restrictions, prohibitive tariffs, and other devices. To a large extent trade depended upon bilateral agreements, many of which would be prohibited under the ITO Draft Charter, unless they were provided for under an international commodity arrangement. In the absence of such an agreement it is probable that chaotic marketing conditions would prevail.

185. Not much is known about the demand for this product though certain evidence indicates that it is relatively inelastic. The demand for salted fish seems to be related to the prices realized for tropical products such as sugar and coffee. There is need for a comprehensive study of the situation upon which a more orderly system of marketing through appropriate agreements between producers and consumers can be based.

186. The Commission recommends that the Fisheries Division of FAO should undertake comprehensive investigation and analysis of the salted fish situation. Such study should give consideration to all factors influencing production, price, consumption, and trade, including the interrelation between salted fish and fresh, frozen, and filleted fish, with a view to ascertaining whether in the near future the salted fish situation will correspond to the group of conditions set forth in Article 46 of the ITO Draft Charter.

187. The Commission recommends that an interim report on this matter be submitted to governments by 15 July 1947 and that a further report be submitted by 1 December 1947.

188. If the interim report should indicate that in the near future the salted fish situation will correspond to the set of conditions set forth in Article 46 of the ITO Draft Charter, the FAO should recommend to governments that a Study Group be established in accordance with Chapter VII of the ITO Draft Charter to convene immediately after the publication of the further report.

189. Such Study Group should consider, on the basis of the reports, whether a commodity agreement with respect to salted fish is desirable or feasible and, if so, what provisions are appropriate with a view to bringing about an expansion of production and consumption with more orderly trading at prices which are satisfactory to both producers and consumers, including the possibility of adding salted fish to any world famine reserves and of programs for disposal of surpluses for approved nutritional projects.

190. The problems connected with international trade in other types of fish and fish products are more complicated. Trade in fresh and frozen fish is to a large extent limited to trade between contiguous countries but, with the continued expansion in the use of refrigerated storage and transport, it can be expected that fresh and frozen fish will play an increasingly important part in world trade. It is, therefore, recommended that, when progress has been made towards a solution of the problems of the salted fish trade, the Fisheries Division of FAO direct its attention to the problems relating to international trade in other fish and fish products.

Imports of Trawl Netting

Before the war, the otter-trawl fleet of the United States imported the greater part of its requirement of netting. England was the principal source with Japan second, while other countries shipped in minor amounts. These nets were made of manila and entered duty free.

The larger New England vessels depended almost entirely on foreign netting, especially for the cod ends. It was claimed that domestic machine-made netting was not as suitable. The meshes of the imported cod ends were hand-made with double twine, which gave greater strength and longer life. To date, no machine has been invented to make this style of cod end.

Starting with 1942, England was the only country still exporting manila trawl netting to this country, but by the middle of 1943 these shipments ceased.

The War Production Board, because of the cutting off of shipments of manila from the Philippines, ruled that manila could be used only for certain sizes of rope. Twine to be made into trawl netting had to be made from sisal or certain other fibers.

To aid the fishing industry, a special allotment of 440,000 pounds of sisal a year, which was to be made only into fish netting, was set aside. Because the facilities in this country for the hand-making of cod ends were not adequate, permission was granted to American dealers to import from England up to 50,000 pounds of sisal cod ends, per year.

Data on the quantity of sisal trawl netting and cod ends imported during the last four years, are shown in the table below. For comparison, the quantity of manila trawl netting and cod ends imported for the years 1939 to 1946 are given. The total from the United Kingdom and from Japan are also reported.

Imports of Trawl Netting and Cod Ends in Recent Years

Year	Sisal trawl netting and cod ends from U. K.	Manila Trawl Netting and Cod Ends			
		United Kingdom	Japan	Others	Total
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1939	*	733,265	213,013	40,891	987,169
1940	-	635,170	303,736	138,816	1,077,722
1941	-	624,803	138,618	680	764,101
1942	*	188,315	-	-	188,315
1943	12,828	68,952	-	-	68,592
1944	156,600	-	-	-	-
1945	161,600	-	-	-	-
1946	215,000**	688	-	-	688

*No exact data available, but estimated to be very small.
**Estimated from import value.

Leading Fishing Ports in 1946

The leading fishing ports in the United States in 1946, in weight of fish landed, were San Pedro, Calif.; Lewes, Del.; Gloucester and Boston, Mass.; and Reedville, Va.; according to an announcement by the Fish and Wildlife Service. In terms of the value of the landings, San Pedro held first place, followed by San Diego, Boston, New Bedford, and Gloucester, in the order named.

San Pedro, which has held the title of leading United States fishing port for three consecutive years, received most of the pilchards and mackerel landed on the Pacific coast and nearly half of the tuna. Landings at San Pedro in 1946 totaled approximately 583,000,000 pounds, with a value to fishermen estimated at $17,000,000.

Lewes, Del., area rose from sixth place in 1945 to second in 1946 because of the tremendous increase in the landings of menhaden. Lewes, largely a menhaden area, handled 276,000,000 pounds last year compared with 175,000,000 in 1945, becoming not only the first ranking Atlantic coast port in volume of landings but the United States center of the menhaden fishery.

Gloucester, among the three leading ports in the United States for two years in succession, received 218,000,000 pounds of fish. About 60 percent of the Gloucester landings consisted of a single species -- rosefish. Compared with 1945, landings at Gloucester increased by about 2 percent.

Landings at Boston amounted to 158,000,000 pounds, consisting chiefly of miscellaneous groundfish like cod, haddock, pollock, and flounders. Although Boston's landings were smaller than Gloucester's, their total value was greater: $13,700,000 compared with $10,800,000. This difference is due to the fact that haddock and cod, which are the chief items in the landings at Boston, bring a higher price than the leading Gloucester species, rosefish.

The phenomenally successful year in the menhaden fishery was responsible for bringing Reedville, Va., from tenth place among U. S. fishing ports in 1945 to fifth place last year. Reedville received approximately 147,000,000 pounds of menhaden, its sole fishery product, compared with 80,000,000 pounds in 1945.

Although San Diego, with about 125,000,000 pounds, ranked below the first five ports in volume of landings, the high value of the fish brought into this port entitled it to second place in terms of value. San Diego received more than half the Pacific coast tuna in 1946, considerable quantities of mackerel, and a variety of other fish in small quantities. The value of all fish landed here in 1946 was about $15,000,000.

Fish landed at New Bedford--haddock, flounders, and other species for the fresh fish markets--were valued at $12,200,000. Compared with 1945, the volume of landings at this port declined about 10 percent: from 101,000,000 pounds in 1945 to 90,000,000 in 1946.

The failure of the 1946 pilchard fishery in northern and central California caused the ports of Monterey and San Francisco, usually among the leading five to decline to less important positions this year. Both of these ports ordinarily handle an enormous tonnage of pilchards, but last year only small and scattered schools of these fish appeared in the area. San Pedro, on the other hand, enjoyed a highly successful pilchard season.

Purchases of Fish by Department of Agriculture

Purchases of fishery products by the U. S. Department of Agriculture amounted to $7,450,843 during December. Compared with November, this was an increase of $6,703,596. Only canned salmon and canned pilchards were purchased during the month. From January 1 to December 31, total purchases reached $19,482,367.

Purchases of Fishery Products by USDA

Commodity	Unit	December 1946		January-December 1946	
		Quantity	F.O.B. Cost	Quantity	F.O.B. Cost
FISH			Dollars		Dollars
Fish, ground, canned	Cases	-	-	229,000	794,000
Herring, "	"	-	-	12,688	77,565
Mackerel, "	"	-	-	48,117	414,760
Salmon, "	"	330,754	5,388,845	1,042,676	14,627,277
Pilchards, "	"	311,682	2,061,998	627,829	3,495,328
Sardines, "	"	-	-	15,929	73,437
Total	"	642,436	7,450,843	1,976,239	19,482,367

Rehabilitation of Philippine Fisheries

A program of rehabilitation and development of the fisheries of the Philippine Islands is being undertaken by the Fish and Wildlife Service, in cooperation with the Philippine Government, according to an announcement of Secretary J. A. Krug on January 26. The fishery program is one of several Philippine rehabilitation programs authorized by the Philippine Rehabilitation Act of 1946, passed by the 79th Congress and approved on April 30, 1946. These programs are coordinated by the Department of State and are being carried out in the Philippines under the general supervision of the American Ambassador. Dr. H. J. Deason, Chief of the Office of Foreign Activities of the Fish and Wildlife Service, will have general direction of the fishery rehabilitation work. Hugh W. Terhune has been appointed Field Administrator of the program with headquarters in Manila.

The fishing industry of the Philippines, normally one of the chief sources of protein foods in the Islands, was largely destroyed by combat action and through confiscation by the Japanese occupation troops. Practically no vessels, fishing gear, or shore facilities remained at the end of the war.

The new program will seek to aid in the early restoration and development of fisheries. Oceanographic and biological studies and experimental fishing operations will be conducted at sea to provide basic information on the fishery resources of the Islands and also to test new and improved methods of fishing which might be adopted by the Philippine fishing industry.

In addition to assisting the development of the marine fisheries, the program also will be concerned with improving the methods of the salt water pondfish industry, which provides a substantial part of the fresh fish supply for the Philippine Islands. Research will also be conducted on the processing of fishery products and in market development and distribution.

The marine research and exploratory fishing will be conducted by two vessels which the Fish and Wildlife Service has recently acquired by charter from the United States Maritime Commission and which are now being converted and outfitted

in shipyards in the San Francisco area. One vessel, the former LT-581, which has been named the Spencer F. Baird in honor of the first United States Commissioner of Fisheries, is being converted into a combination oceanographic vessel and tuna clipper. The second vessel, the former AMC-90, which has been named the Theodore N. Gill in honor of a famous American ichthyologist, is being converted into a combination fishing vessel which will be equipped to operate purse seines and various types of trawls. These vessels will be ready to sail for the Philippines about the middle of March.

The Field Administrator, Mr. Terhune, and his assistant Dr. Herbert E. Warfel, who will be in charge of the biological and oceanographic programs, will assist the American Embassy in concluding final arrangements for the program.

U. S. Foreign Fish Trade

"United States Foreign Trade in Fish and Fish Products," a 36-page illustrated report recently issued by the Department of Commerce, may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., or any of the Department of Commerce's field offices for 5 cents a copy.

It is also designated as Part 5, Foodstuffs, Fats and Oils, Number 27, December 1946, in the Industrial Reference Service.

Waste Fish

The recently issued Report of the Danish Biological Station for 1943-1945 is in English and contains a report entitled "On the Waste Fish Fishery," by Dr. H. Blegvad, Director of the Station in Copenhagen.

Waste fish are defined as fishes "unfit for human food but are used for fish fodder or fish meal."

The report discusses the yield of the fishery, the composition of the catch, the influence of the fishery in the stock of fishes, and what can be done to counteract the damaging effects of the waste fish fishery.

Wholesale and Retail Prices

The wholesale price of foods increased 7.5 percent from mid-September to mid-October, and retail prices of all foods increased 3.4 percent for the same period, according to reports from the Bureau of Labor Statistics, Department of Labor. The retail prices of fresh and canned and fresh and frozen fish rose 12.8 and 16.8 percent, respectively, over prices of October 16, 1945. The retail price of pink salmon rose 0.3 percent and that for red salmon, 3.6 percent from mid-September to mid-October 1946.

Wholesale and Retail Prices

Item	Unit		Percentage change from--	
Wholesale: (1926 = 100)		Oct.12,1946	Sept.14,1946	Oct.13,1945
All commodities	Index No.	126.0	+3.5	+19.7
Foods	do	137.7	+7.5	+30.9
Fish:		Oct. 1946	Sept. 1946	Oct. 1945
Canned salmon, Seattle:				
Pink, No. 1, Tall	$ per doz. cans	2.588	+6.2	+31.4
Red, No. 1, Tall	do	4.729	+3.5	+28.0
Cod, cured, large shore, Gloucester, Mass.	$ per 100 pounds	13.90	+2.9	+2.9
Herring, pickled, N. Y.	¢ per pound	12.0	0	0
Salmon, Alaska, smoked, N. Y.	do	35.0	0	0
Retail: (1935 = 100)		Oct.15,1946	Sept.17,1946	Oct.16,1945
All foods	Index No.	180.0	+3.4	+29.2
Fish:				
Fresh and canned	do	249.7	+5.0	+12.8
Fresh and frozen	¢ per pound	43.3	+6.2	+16.8
Canned salmon:				
Pink	¢ per pound can	24.1	+0.3	- 2.4
Red	do	43.2	+3.6	+ 7.5

* * * * *

The wholesale price of foods declined 6.5 percent between October 19 and November 16, 1946, but retail prices for all foods increased 4.3 percent for the same period. The retail index for all foods now reflects fully the current level of prices for meats as well as the entire price change that occurred since mid-August 1946, according to reports from the Bureau of Labor Statistics, Department of Labor. The retail prices of fresh and canned and fresh and frozen fish rose 6.1 and 0.6 percent, respectively, from mid-October to mid-November and showed increases of 20.0 and 17.7 percent, respectively, over prices of November 15, 1945.

Wholesale and Retail Prices

Item	Unit		Percentage change from-	
Wholesale: (1926 = 100)		Nov.16,1946	Oct.19,1946	Nov.17,1945
All commodities	Index No.	135.8	+0.5	+27.8
Foods	do	164.1	-6.5	+53.1
Fish:		Nov. 1946	Oct. 1946	Nov. 1945
Canned salmon, Seattle:				
Pink, No. 1, Tall	$ per doz. cans	3.189	+23.2	+61.9
Red, No. 1, Tall	do	5.363	+13.4	+45.2
Cod, cured, large shore, Gloucester, Mass.	$ per 100 pounds	14.50	+ 4.3	+ 7.4
Herring, pickled, N. Y.	¢ per pound	12.0	0	0
Salmon, Alaska, smoked, N. Y.	do	35.0	0	0
Retail: (1935 = 100)		Nov.15,1946	Oct.15,1946	Nov.15,1945
All foods	Index No.	187.7	+4.3	+34.0
Fish:				
Fresh and canned	do	265.0	+6.1	+20.0
Fresh and frozen	¢ per pound	43.5	+0.6	+17.7
Canned salmon:				
Pink	¢ per pound can	31.1	+29.2	+26.0
Red	do	52.1	+20.6	+29.0

FOREIGN FISHERY TRADE

Imports and Exports

GROUNDFISH IMPORTS: From January 1 through December 31 there were 49,171,089 pounds of fresh and frozen groundfish imported into the United States under the tariff classification, "Fish, fresh or frozen fillets, steaks, etc., of cod, haddock, hake, cusk, pollock, and rosefish." This was 6,001,933 pounds greater than the groundfish imports for the corresponding period in 1945, according to reports from the Bureau of Customs, Treasury Department, and the Bureau of the Census, Department of Commerce.

Commodity	December 1946	November 1946	December 1945	Jan.1-Dec.31,1946	Jan.1-Dec.31,1945
Fish, fresh or frozen fillets, steaks, etc., of cod, haddock, hake, cusk, pollock, and rosefish	1,458,080	3,024,902	2,643,199	49,171,089	43,169,156

Canada

COLD STORAGE: Canadian holdings of frozen fishery products totaled 38,511,000 pounds on January 1, according to a preliminary report received from the Department of Trade and Commerce, Dominion Bureau of Statistics. Compared with stocks held on December 1, this was a decline of 4,310,000 pounds, but was 10,782,000 pounds greater than holdings on January 1, 1946.

* * * * *

FISH FILLETING PLANT: A portable fish filleting plant was put in operation at Meadow Lake in December 1946 by the Saskatchewan Fish Board, according to David F. Corney, Manager of the Meadow Lake plant. At present it comprises a portable freezing unit, which consists of a stainless steel body, 22 feet long and 8 feet wide, mounted on a heavy truck chassis, with dual wheels front and back. The entire body is insulated with spun glass and is divided into two compartments--the control room which houses two 3 hp. refrigeration units and a holding room which has a quick-freeze compartment capable of holding approximately 500 pounds of fish. The refrigerant used is Freon. The capacity of the quick-freeze is in the neighborhood of 3,000 pounds of frozen fillets per 24 hours.

The portable freezing unit is designed to connect to a refrigerated truck box which is also made of stainless steel and insulated with spun glass. The box has a hold-over period of approximately 60 to 70 hours after being disconnected from the portable freezing unit, and holds approximately 4,000 pounds of processed fillets. Its purpose is to transport the frozen products directly from the lake to the cold storage plant at headquarters and maintain them in a frozen condition.

A Diesel power unit completes the portable freezing unit. Plans are being made for a filleting room, built in sections, which will go right to the lake on a trailer where it will be assembled ready for operations.

The primary reason for having a portable filleting plant and freezing unit is because a large proportion of Saskatchewan's lakes are in remote areas. As the fish must be kept in first class condition, it saves time and money to process them, fresh out of the water, right at the lake. It also minimizes the possibility of deterioration, which might be brought about by poor roads or abnormal weather conditions. Further, tonnage is cut down when only the finished product is transported to the warehouse.

* * * * *

MARKETING SMOKED FILLETS: Smoked fillets of fish are now being marketed by the Saskatchewan Fish Board, Resources Minister J. L. Phelps has announced.

Produced at the newly-established filleting plant at Meadow Lake, the fillets available include smoked whitefish, trout, pickerel, jackfish, and mullet. The plant is able to process about 1,000 pounds of fish daily.

Production of this product is still on an experimental basis, and the board is processing various kinds of fish to see which is the most suitable for the market and most economical for smoking purposes.

* * * * *

HERRING PRODUCTION: Practically all of the herring landed by British Columbia fishermen are caught in the immediate vicinity of the shore of Vancouver Island and the fishery is known as a "shore fishery," according to the American Consulate General in Vancouver, B. C., Canada. The main season runs through the fall and winter months with huge catches being taken. During the 1946-47 season fishermen landed approximately 114,141 green tons of herring by means of purse seining, for the most part, although some gill net fishing was conducted. The price was fixed at $6.30 a ton in canning areas and $5.15 a ton in all other areas.

In prewar days, a production of even a million cases of herring would not have been thought of for the very good reason that there was no peacetime market for any such quantity. The 1946-47 pack, totaling 1,511,887 cases, each containing 48 pounds, as of February 1, 1947, is shown below:

Can Size	Plain Pack	Tomato Pack	Total Pack
1 lb. tall	242,322	62,959	305,281
1 lb. oval	671,511	484,886	1,156,397
¼ lb. oval	11,035	39,174	50,209
Total	924,868	587,019	1,511,887

The pack was allocated as follows: British Ministry of Food, 75,000 cases; UNRRA, 450,000 cases; and for commercial purchases for consumption in areas where food is scarce, 987,000 cases.

This year there was a wide variation in prices, commercial importers paying from $5.75 to $9.00 a case f.o.b. Vancouver for herring in oval tins packed in tomato sauce.

In addition to the herring canned and the quantities sold in other forms for human consumption, approximately 8,416 tons of herring meal and herring offal meal were produced and sold in the domestic market at a ceiling price of $1.07½ per unit of protein per ton. Exports were rigidly controlled due to the fact that the Canadian market was in short supply.

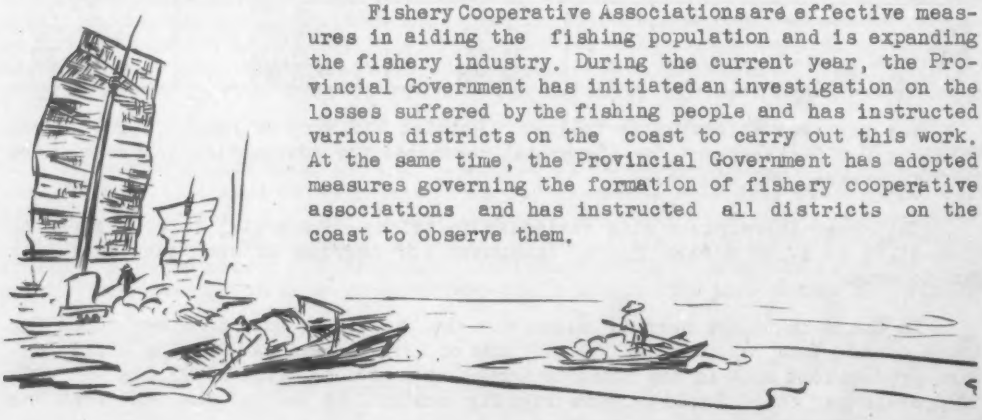
Herring oil and herring offal oil production during the 1946-47 season is shown as 837,644 Imperial gallons. The domestic ceiling price was fixed at sixty cents per seven and a half pounds in naked form f.o.b. Pacific terminal points. There was also an embargo on exports of herring oil.

The industry outlook for the following season is dependent upon the overseas demand for a cheap, nutritious food. In all probability, the pack will be considerably smaller, as the market in the Orient for dried salt herring has not developed to prewar proportions. It is possible that more herring will be converted into fish meal and fish oil. In this event, the industry hopes that the Canadian Government will remove the embargoes affecting export shipments.

China

FISHING INDUSTRY: The province of Kwangtung is the most ideal fishery base in south China, states a recent report from the American Consulate General, Canton, China.

It has a zig-zag coast line of over 1,000 miles, with fishing inlets dotted everywhere and fishery products in abundance. Its activities in the past covered a fish-breeding section established by the Department of Industry, an experimental area instituted by the Department of Reconstruction, a fish-producing section formed by the Second Division of the Reconstruction Department, a seafood products division set up by the Bureau of Agriculture, a fishery administration located at Kweng Hei, Chaechow, and Swatew, and the Liang Kwang Large-scale Fish Producing Station established jointly by this province and the Kwangsi Provincial Government. As a result of the war, the above institutions were forced to close down one after the other and the whole industry suspended operations. After the Japanese surrender, being aware that the establishment of these structural organizations is prerequisite to the development of fishery industry, it is planned to form the Provincial Fishery Administration and four fishery administrative districts. This planning has been drafted and submitted to the Central Government at Nanking for funds to be allocated for this enterprise.



Fishery Cooperative Associations are effective measures in aiding the fishing population and is expanding the fishery industry. During the current year, the Provincial Government has initiated an investigation on the losses suffered by the fishing people and has instructed various districts on the coast to carry out this work. At the same time, the Provincial Government has adopted measures governing the formation of fishery cooperative associations and has instructed all districts on the coast to observe them.

Prior to the war, this Province had a fishing population of 800,000 and more than 35,000 old type fishing boats. Fishing people killed by the enemy during the war amounted to 50,000 or 60,000 and 60 percent of their fishing boats were destroyed. The fishermen and their families are in urgent need of relief.

The Department of Reconstruction has undertaken measures for encouraging fishmongers to ship fresh water fish to Formosa for stocking lakes and rivers and has instructed various districts on the West River Coast to carry out this plan.

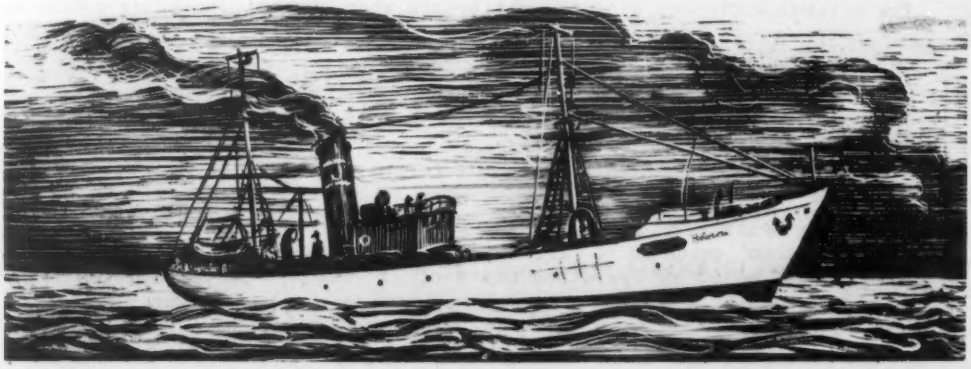
Germany

GERMAN FISHING VESSEL CONSTRUCTION PROGRAM: A meeting of the labor unions and the German Deep-Sea Fishing Association passed a unanimous resolution to reject the program outlined by the Allied Control Council to construct fishing vessels in order to improve the German fishing fleet, according to a report of the American Consulate in Bremen, Germany, which was based on an item in the German press in November. The program provides for the construction of 100 fishing vessels, but restricts 34 vessels to a maximum of 400 gross register tons, whereas the other 66 vessels must not be larger than 350 gross register tons. The approved length of the vessels, 141 feet, practically means that only ships with a maximum of 350 gross register tons can be constructed.

Economic Operations: It is not only the intention to increase catches but also to reduce operation costs in order to keep fish prices at a low level. Comparing the larger sized with the smaller sized vessel clearly shows the advantages of the larger types. A comparison of the outer measures shows the following:

	164 feet	141 feet	Difference
Length over all	164 ft.	141 ft.	-14 percent
Tonnage	500 grt.	350 grt.	-30 "
Engine performance	750 hp.	600 hp.	-20 "
Bunker coal space	250 tons	180 tons	-80 "
Fish storage space	4200 ctw.	2500 ctw.	-42 "
Speed	12 knots	10.5 knots	-13 "

Although the smaller type is only 14 percent shorter than the larger, its storage space is 42 percent less. The difference in speed is comparatively small



but is of great importance in landing catches as quickly as possible. The difference in engine performance is very important because it enables larger catches, deeper fishing, and longer trips.

Construction Costs: Construction costs of the vessels are indicated in the following figures:

	164 feet	141 feet	Difference
Steel	320 tons	220 tons	
Boiler-Sheeting Machinery castings Cast iron	260 "	200 "	
Total	580 "	420 "	-28 percent
Lumber	140 CBM*	100 CBM*	-30 "
Working hours	200,000 hrs.	150,000 hrs.	-25 "
Construction costs	900,000 rmk.	700,000 rmk.	-22 "

*CBM = Cubic meter, a German unit of measure corresponding to 'board foot' in this country.

In regard to size and fishing capacity construction costs of the smaller type are more unfavorable than for the larger type. The same applies to the use of iron and lumber as well as estimated working hours. In addition, there is a comparatively slight difference in consumption of coal and electric power for the production of the materials required.

Operating Costs: Operation costs show even more clearly the unfavorable results of the smaller type:

	164 feet	141 feet	Difference
Coal consumption per day	9.5 tons	8.5 tons	-12 percent
Nets and equipment	nearly the same		0 "
Cost of repairs	" " "		0 "
Amounts written off			-25 "
Crews	20 men	14 men	-30 "

The foregoing table shows but a slight difference in the costs of operation. Expenditures for equipment and repairs are practically the same. Crew costs are somewhat higher, but are hardly worth mentioning in view of the comparatively small percentage in total operation costs. The consumption of coal is practically the same and, considering the present German supply, should receive particular attention.

The following figures show the difference when comparing catches and costs of operation:

	164 feet	141 feet	Difference
Estimated annual catches	5,511,500 lbs.	2,755,750 lbs.	-50 percent
Estimated total costs of one trip	-	-	-25 "
Average operation costs per 100 German pounds	-	-	+50 "

Operation costs for one trip of the smaller type is but 25 percent less; whereas, the annual catch is 50 percent less which indicates that only 50 percent as much fish is landed at operation costs of at least 75 percent of the larger type, thus increasing the average operation costs per hundred German pounds (CTW,

equalling 110.23 avoidupois pounds) by 50 percent. That increase can only be balanced by a corresponding increase in the price of fish.

Restricted Radius of Operation: The restriction to permit operation of smaller fishing vessels only, will unavoidably tend to fishing in waters near the home ports. Although smaller vessels may be seaworthy, their radius of action will be comparatively restricted, as they cannot fish in greater depths than 400 meters. Excessive fishing in the North Sea was already a problem before the war for all international fishing companies. Increased activity of steam-fishing vessels in the North Sea would undoubtedly result in a sharp decrease in fish, thus constituting a danger for all countries interested and fishing in those waters.

German fishing companies already recognized the disadvantages of the smaller types of ships long before the war, and a tendency to construct larger vessels was noticeable after 1928 and 1929. Since that time and even during the war, 166 ships of the 164-foot type were constructed. Of those vessels, 125, or 27 percent of the total fleet of 459 vessels, were sunk during the war. The present fishing fleet comprises 132 vessels, including 32 vessels of the 164-foot type. Catches show that those 32 ships are much superior to the remaining 100 of the smaller type. Catches during the period July 1, 1945 to September 15, 1946, are given as follows:

	Fishing Days	Catches in lbs.	Average Catches per day in ctw.
100 ships smaller than 164 ft.	17,939	196,764,000	99
32 ships of 141 ft.	5,016	101,103,000	189

The figures reflect practical experiences during the past year and show that the big ships landed almost double the quantity of fish per fishing day.

Fish Supply of the German Population: The supply of fish for the German population has been fixed at 12.5 kilos (27.5 pounds) per capita and year, which indicates that 798,000 metric tons (1,755,600,000 pounds) of fish will be required annually. The plan set up estimates that approximately 439,000 tons can be produced by domestic deep-sea, coastal, and inland fishing, while 225,000 tons have to be imported. The difference of approximately 134,000 tons has to be filled by construction of new fishing vessels. However, there are also many old and dilapidated vessels which have to be replaced. If construction is restricted to the smaller type, it would require almost twice as many fishing vessels as of the larger type.

Iceland

HERRING INDUSTRY: Approximately 4,000 metric tons of herring were caught by 39 Icelandic vessels operating just outside of Reykjavik harbor during the period January 17 to February 12, according to a report from the local American Legation. All of this herring has been sent to Siglufjord on the north coast for reduction into herring oil and meal. It is estimated that the oil and meal to be produced will be worth about $230,000.

The fishing activity is continuing, and it is believed in some quarters that this may be the start of a winter herring industry which will supplement the rich north coast herring season each year in July and August.

India

POSTWAR DEVELOPMENT: In the course of a speech, Bombay's Minister for Fisheries, assured the fishing trade that the Government of Bombay is anxious that all possible steps should be taken at an early date for the development of fisheries in this province on right lines, according to a report of the American Consulate General in Bombay, India. Dealing with the Government's plans toward this end, the Minister disclosed that the Bombay Government has sought the assistance of the Government of India to secure the services of a master fisherman from Japan. According to the Minister, Bombay will soon have an aquarium and marine biological station, and efforts will be made to establish research stations at convenient places. Young fishermen will be enabled to proceed abroad to obtain knowledge of the most up-to-date methods of fishing. The number of fisheries schools (of which there are at present five) will be increased. Fishermen's cooperative societies will be encouraged by subsidies and loans. Supplies of twine for making nets, which were short during the war, are now adequate. The Minister felt that there should be a network of ice factories throughout the coastal belt for affording cold storage facilities.

Ireland

FISHERIES: In 1945, Eire's sea fisheries amounted to 371,937 cwt.[1] (41,657,000 pounds), valued at £551,820[2] ($2,226,593), exclusive of shellfish which were valued at £127,926 ($516,181), according to its Report on the Sea and Inland Fisheries for the Year 1945. Demersal, or bottom fish, made up 18,374,160 pounds of the total; herring, 12,128,256 pounds; and mackerel, 10,703,616 pounds.

Persons engaged in the sea fisheries numbered 1,886 full time and 8,191 part time workers. The 3,472 vessels included 3 deep-sea steam trawlers, 568 motorboats, 758 sailboats, and 2,143 oared craft.

Japan

FISHERIES: Japanese fish landings for November amounted to 156,655 metric tons, exceeding the previous month's catch by 25 percent, according to General MacArthur's report on Japan for the month of December.

1/Cwt. = 112 U. S. pounds.
2/1945 official rate of exchange of pound sterling equivalent to $4.035.

Two Japanese whaling fleets arrived in Antarctic grounds during December, and, by the end of the month, had landed 167 whales. In addition, Japanese coastal whalers caught 121 whales in the six-week period ending December 28.

The earthquake which struck southern Japan on December 21 caused the loss of 2,602 fishing vessels.

Mexico

SHRIMP INDUSTRY: Shrimp fishing during January 1947 showed an increase in the number of boats operating, but catches were reported to be spotty and voyages had to be extended to obtain paying loads, according to the United States Embassy's Monthly Economic Review for Guaymas, Sonora. The freezing plants found a ready market in the United States for jumbo size shrimp, and normal shipments went forward. Stocks of smaller sizes were accumulated and held in the hope of a better market price. A new freezing plant began manufacturing ice and an expected 18 to 20 tons of ice a day will be available to the fishing fleet.

Netherlands

FISHERIES: The 1946 fishing season was a memorable one for the Netherlands, according to a report from the American Embassy at the Hague. With a fleet less than two-thirds prewar capacity at the close of the season, catches from the bountiful North Sea banks were such, that the total harvest of herring and other sea fish equaled 1938 production. Total catch is estimated at about 142,000 metric tons, of which 68 percent was herring. Oysters and shellfish will add another estimated 48,000 tons. As a result of the meat shortage, total consumption of sea fish in the Netherlands has doubled prewar figures. Approximately 75 percent of the herring and sea fish went into domestic consumption, while for oysters and shellfish the estimate is about 40 percent. Good distribution facilities have made fish available even in the smallest towns, at least once a week, and in many places, oftener.

Government controls, particularly in the matter of price regulation, were equally strong in the fishing industry. Maximum prices are fixed, generally at the beginning of the fishing season, for the fishermen, wholesaler, and consumer. All fish, as is the case with fruits and vegetables, must be sold at auction under state supervision in the larger auctions such as Ijmuiden and Scheveningen, while in the smaller centers it is usually under joint control of the municipal officials and fishermen's organization. Whenever maximum prices are realized at auction, distribution is arranged by state officials who indicate different wholesalers to whom the fisherman will deliver his product. This is done for the intended purpose of securing adequate distribution. When supply is in excess of demand, the fisherman can deliver his product as he wishes.

Newfoundland

REGULATIONS: The regulations covering the filleting and freezing of fish, made by the Newfoundland's Commissioner for Natural Resources and referred to in the December 1946 issue of Commercial Fisheries Review (p. 50), are reported in full by the American Consul General at St. John's, as follows:

1. In these Regulations unless the context otherwise requires--

   (a) "Board" means the Newfoundland Fisheries Board;

   (b) "Fish" means all types of marine fishes including shellfish;

   (c) "Fillet" means fish from which all guts, bones, head, tail and fins have been removed, or, as the context requires, to remove all such parts from fish, and grammatical variations of the term shall be construed accordingly;

   (d) "Inspector" means any person authorized by the Board to act as an Inspector for the purposes of these Regulations;

   (e) "Person" shall include any body of persons, corporate or unincorporate and any society or association;

   (f) "Non-fatty" fish shall include cod, haddock, flounder, rosefish, hake (also called ling), cusk, and pollock.

2. All premises used in the filleting or freezing of fish shall have an adequate supply of clean, fresh or sea water free from pollution and all such premises and the equipment and implements used therein shall at all times be kept in a thoroughly clean and sanitary condition.

3. Fish showing any signs of deterioration, decomposition, or sourness shall not be filleted and fillets which are soft or show any such signs shall not be frozen.

4. When fillets cut from scale-type fish are to be marketed with skin on, the fish shall be scaled before filleting, in accordance with a method approved by the Board.

5. Immediately before any fish is filleted such fish shall be thoroughly washed in fresh or salt water which is projected directly on to such fish from a jet or pump.

6. Fillets, when stored in ice for transportation or holding before freezing, shall be kept packed in finely crushed ice in boxes the sides of which are not more than eight inches deep on the inside.

7. Before fillets are frozen, they shall be washed thoroughly clean in fresh or sea water and all blood clots or other deleterious matter shall be removed from them.

8. Immediately after fillets of non-fatty fish are washed and trimmed they shall be dipped in a clean sodium chloride brine solution for a sufficient time to strengthen the cell structure and to ensure a minimum amount of drip after defrosting. Whenever available, fresh water shall be used in making the sodium chloride brine solution.

9. Immediately after fillets are brined and drained they shall be weighed and placed in the wrapper and or container in which they are to be frozen and, until such fillets are put through the freezing process,

they shall be held in a refrigerated holding room at a temperature not higher than 40 degrees Fahrenheit.

10. Scales, balances, or weighing machines used in the weighing of fillets shall be accurate at all times, and in the weighing of fillets for freezing due allowance shall be made for evaporation during freezing.

11. All packages containing fillets for sale or export shall be plainly marked with a true and correct description of the contents, including the minimum weight in avoirdupois of the contents, and the name and address of the person, by whom they are packed.

12. The descriptive term "quick frozen" with its grammatical variations, as applied to the freezing of fish, shall not be used without the permission in writing of the Board. Such permission shall be granted only where the Board is satisfied that the process used is such that the fall in temperature of the fish during freezing from 32 degrees Fahrenheit to 25 degrees Fahrenheit occurs at a speed which ensures a minimum disturbance of tissue structure. Fish shall not be removed from the freezer before the fish reaches storage temperature.

13. Frozen fillets shall be kept stored at a temperature not higher than 5 degrees above zero Fahrenheit.

14. An Inspector may--

(a) Inspect any place in respect of which application is made for its use as a plant for filleting of fish or the freezing of fillets;

(b) Inspect any place for the filleting of fish or the freezing of fillets and the equipment used therein, and enquire into and ascertain the methods used and the sanitary precautions taken, and other matters in connection therewith;

(c) Inspect fillets and fish intended for use in the preparation of fillets;

(d) Take samples for further examination; and

(e) Initiate in his own name as Inspector and conduct prosecutions for breaches of these Regulations or offences thereunder.

15. If, after being requested to do so by an Inspector, any person who has in his possession or under his control any fillets or any fish intended for use in the preparation of fillets or who is the holder of a license issued and valid under the Processed Fish (Licencing) Regulations, 1944, to process fish, refuses or omits--

(a) To admit the Inspector into the plant in respect of which the licence is held;

(b) To show the Inspector all equipment in such plant, and the methods used in the plant;

(c) To produce any such fillets or fish for inspection, or

(d) To permit the reasonable taking of samples for examination

he shall be guilty of a breach of these Regulations.

16. No person shall export fillets unless they have been inspected and passed by an Inspector and if fillets are not exported within six months from the date of inspection, they shall not be exported without re-inspection.

17. The Inspector shall give an inspection certificate to the licencee or exporter and such certificate shall show the number of packages inspected and passed, the date of inspection and the name of the Inspector.

18. These Regulations may be cited as the Processed Fish (Filleting and Freezing) Regulations, 1946.

NOTE: Every person who commits a breach of any rules or regulations made under the Department of Natural Resources Acts, 1934-44, is liable for each offence on summary conviction at the suit of any person to a fine not exceeding two hundred dollars, or, in default of payment, to imprisonment for a period not exceeding three months.

Norway

FISHERIES: Norway's total fish catch for 1946, estimated at 835,000 metric tons valued at about $47,000,000, was about 100,000 tons greater than the 1945 catch, while the value of the catch was the highest on record, according to the American Embassy in Oslo, Norway, in the Annual Economic Review, 1946.

The year's cod catch of 169,000 metric tons valued at $8,800,000 was unusually large. The catch of winter herring, which ended in March, totaled 3,820,000 hectoliters (343,800 metric tons) as compared with 3,759,000 hectoliters (338,310 metric tons) the year before. The spring herring catch amounted to 2,448,000 hectoliters, (220,320 metric tons), a satisfactory figure. The total catch of fat herring up to November 2, 1946, was 269,000 hectoliters (24,210 metric tons) as compared with 308,000 hectoliters (27,720 metric tons) for the entire year 1945.

Mackerel fishing suffered considerably from lack of equipment. Coalfish fishing was generally good. Shark fishing was unsatisfactory off Spitzbergen, but good on the North Sea banks. The lobster and shrimp catches were good. The catch of seals off Greenland was large, but the Spitzbergen catch was unsatisfactory.

The total catch of Norwegian whaling companies in the 1945-46 season was 7,233 whales with an oil production of 520,811 casks, compared with 11,040 whales caught and 909,800 casks of oil produced during the 1939-40 season. The value of the 1945-46 catch, about $25,000,000, was the highest since the record 1930-31 season.

During the year, a law was passed prohibiting Norwegian companies or subjects from engaging directly or indirectly in whale fishing with foreign flag vessels, except upon receipt of special permission which could be given when a foreign company desiring to employ Norwegian seamen had engaged in Antarctic whaling during the last season before September 1939, or when the employment of Norwegians is

on a floating factory which was used for whaling before that time. Such special permission was granted during the year to enable Norwegian personnel to be employed on the Russian floating factory Slava, formerly the German Wikinger.

* * * * *

INTERNATIONAL WHALING: The International Bureau of Whaling Statistics at Sandefjord, Norway, has informed the Fish and Wildlife Service that up to February 22, 1947, the factory ships of various nations whaling in the Antarctic had captured a total of 10,414 blue whale units. Under international agreement, the maximum catch quota for the 1946-47 Antarctic season, which extends from December 8, 1946, to April 7, 1947, has been fixed at 16,000 blue whale units.

Spain

FISHERIES: The fish catch in 1946 was about the same as in 1945 (510,000 tons), the national fishing syndicate and the Consulate at Vigo tentatively report, according to the Annual Economic Report on Spain for 1946, from the United States Embassy in Madrid. However, the sardine catch was only about 30 percent of that in 1945. The lack of olive oil for fish packing, higher prices paid in the domestic market and, to a minor degree this year, the shortage of tinplate, continued to restrict operations.

The fishing industry has also been handicapped by disagreements between the packers and the syndicate. Moreover, the price fixing and fresh fish distribution priorities systems have not always met with approval. While canned fish exports were almost negligible as compared with 1935, still they were more than double in volume the 1945 figure. Until the domestic market price falls somewhat, no substantial amounts of fish for export at lower prices were expected. Meanwhile, former markets were becoming accustomed to the cheaper Portuguese products.

U. S. S. R.

FISHERY PROGRAMS IN THE U.S.S.R.: While visiting the U. S. Fish and Wildlife Service Laboratory in Seattle, Dr. Alexander S. Bogdanov, Director of the Institute of Fishing and Oceanography at Moscow, U.S.S.R., was introduced by Mr. Harlan B. Holmes, Service biologist, to the biological and technological staffs and addressed them through his interpreter, Mr. V. C. Vezey. The stenographic record made of his talk is reproduced here with minor revisions as to spelling and grammar as made by Dr. Bogdanov and Mr. Vezey. Dr. Bogdanov came to this country late in November 1946, to attend the International Whaling Conference in Washington, D. C., and was taking this opportunity to visit the principal fishing centers and research laboratories of the U. S. Fish and Wildlife Service. His position in the Soviet Union is comparable to that of the Commissioner of the former Bureau of Fisheries in this country.

Dr. Bogdanov's remarks were approximately as follows:

I really regret that, while you probably expect an interesting talk, I shall hardly be able to give you one, as the circumstances of my departure for the United States were rather sudden and I came away unequipped with material to deliver an interesting talk. My object, as Mr. Holmes pointed out, was to attend the International Whaling Conference and I did not expect to travel in the United States. However, in Washington I made the acquaintance of some very interesting people, among them representatives of scientific organizations, and it was at their suggestion and with their assistance that the present trip to the Pacific coast was arranged.

To begin with, scientific and research work in the U.S.S.R. is carried on by organizations which may be classified in four groups. To the first group belongs the Academy of Sciences in Moscow (working chiefly in the realm of theory) and the large number of institutes under its jurisdiction. To the second group belong the institutes directed by the various industrial ministries, as is the case of the Institute to which I belong, which is directly responsible to the Ministry of Fisheries. While the Academy of Sciences group is concerned with major scientific problems of national importance, the group working under the Ministries is interested in more immediate problems, each in its own particular field.

The third category comprises universities and colleges throughout the land, and their ability to engage in scientific research is based largely on the requirement for university professors to do such research work over and above their educational activities. There is still a fourth category contributing to research in science; these are the various scientific unions, organizations, and clubs having a common interest in some sort of scientific work, such, for instance, as the Association of Natural History, the Russian Geographical Society, which has just celebrated its 100th anniversary, etc.

Before I take up the work carried on by the Institute of Fisheries and Oceanography, to which I belong, I must point out that it does not work alone in this field. At Leningrad there is the Institute of Lake and River Fisheries, with seven stations throughout the land, chiefly concerned with inland lakes and rivers; in Moscow, there is an Institute working on farm ponds and hatcheries; and, finally, an Institute in Kiev works only on inland waters within the Ukrainian Republic, having also a station at Odessa on the Black Sea.

The Institute of Fisheries and Oceanography, with headquarters in Moscow, has 18 stations strategically situated throughout the country as follows:

Murmansk, on the Barents Sea
Arkhangelsk, on the White Sea
Leningrad
Tallinn and Riga, on the Baltic Sea
Rostov, on the Don River
In the Straits of Kerch, between the Black Sea and the Sea of Azov
Batumi, on the Caucasian Black Sea Coast
Aralsk, on the Aral Sea
Saratov, on the Volga River
Two stations at Astrakhan on the Caspian Sea

Baku, also on the Caspian Sea
Petropavlovsk-on-Kamchatka
One station on Sakhalin Island
Vladivostok, on the Sea of Japan
Khabarovsk, on the Amur River, and
a Permanent Expedition based in Arkhangelsk and working in the Kara Sea

While the work of each one of these stations may be limited to one or more phases of oceanography and fisheries, the Moscow headquarters of the Institute is interested in all such phases, directing work in the following fields:

Ichthyology, breeding (including artificial breeding)
Morphology and embryology
Physiology
Fish diseases
Hydrology
Chemistry of water
Hydrobiology
Fishing techniques
Fish net treatment and maintenance
Salting
Smoking
Marinating and canning of fish
Fish fats
Utilization of fish by-products
Vitamins
Control methods in the fishing industry
Economics

As I have already said, the interests of the various stations may be more limited in scope. For instance, the Leningrad Station specializes in canning; the Saratov Station on the Volga, in breeding sturgeon; the Petropavlovsk Station on the Kamchatka Peninsula, in the biology of salmon and certain other species.

At the Moscow headquarters of the Institute, a Scientific Council, composed of heads of the various laboratories, meets from time to time for the purpose of discussing, working out and submitting for approval, programs for the ensuing periods. The programs are submitted to and approved by the Ministry of Fisheries, sometimes exactly as submitted, sometimes with modifications.

What kind of work does the Institute perform? What are some of its objectives and what are its methods of work?

The war years gave rise, of course, to some very specific problems. War operations resulted in the loss of fishing grounds, such as the Barents Sea in the north and the Black Sea in the south. It was necessary to find new fishing grounds to replace them, or, to put it differently, it was necessary to replace with other species, taken elsewhere, the catch that was no longer taken in the waters within the war zone.

For example, it was decided to turn to the Caspian Sea for a supply of a new kind of herring known as Kilka, but before its fishing could be begun on a commercial scale it was essential to study the location of this population, its breeding, its feeding habits, the various marine life that formed its food, etc. Moreover, the Fishing Techniques Laboratory specialists had to recommend the proper equipment to be used; methods of processing and packing had to be determined and, of course, the Economics Department had to establish proper supervision of this new fishery and the proper marketing of its catch.

This was a big job. However, within a year of receiving instructions to begin, the Institute was able to submit to the Government a complete plan for this new fishery. Two years after operations got under way, the catch rose from 2,000 to 20,000 tons a year.

Perhaps the most important problem which the Institute faces is that of the fish populations of the seas surrounding the Soviet Union and the so-called inland seas; i.e., the Caspian, Aral, and Azov.

Marking fish, particularly for the study of fish migration, is widely used in the Soviet Union, just as it is in the United States. It is used in the northern waters for the study of the migration of cod and in the Caspian Sea, in the south, that of the Volba.

Air reconnaissance is used for locating populations and in this work dirigibles are found to be especially useful. In the White Sea, they help find the Greenland seal, and the seal herds of the northern Caspian and of the northern waters of the Soviet Far East are also found by aerial observation. When a seal herd is spotted, its exact location is charted, the size of the herd is estimated and from that it is determined what part of the herd can be killed by the sealing expedition without unduly depleting the herd.

Planes sometimes set out to find a seal herd and on their way will discover something else of no lesser an interest. In the Black Sea area, for instance, planes sent out to determine the location and distribution of the porpoise observed large schools of the Pelamida off the Crimean and the Caucasian coasts. We decided to organize a Pelamida fishery in these waters.

To chart the areas of these schools and to estimate their size two planes and a dirigible were sent out, each proceeding to an area assigned to it. Some of the schools of the Pelamida were compact, some were sparse. A given area was divided into sectors and the population of a few sectors, taken at random, was estimated and, by the process of interpolation, the population of each of the three areas was determined. The dirigible was found to be very useful because of its ability to come down close above the surface and, using a megaphone, to instruct the crews of the seiners where to set their seines so that they might take virtually a whole school.

In the Sea of Azov, which is very shallow--usually about 40 feet deep--the entire sea was divided into sectors, random catches were counted and the whole population of the Pelamida in that sea was thus determined. In this fishery it was particularly necessary to study the seasonal migration of the Pelamida between the Black Sea and the Sea of Azov through the Straits of Kerch. In the autumn, very heavy catches were made, one season reaching the 70,000-ton mark. A close study of this migration enabled us to determine in advance both the time of the migration and the safe limit of the catch.

Dr. Thompson (University of Washington, School of Fisheries) has asked me whether it was true that hydrological conditions in the Black Sea forced the fish population to live near the surface. Bottom varieties in the Black Sea are found only in the coastal areas; in the open sea there is a concentration of sulphur dioxide at a depth of some 650 feet, a condition which led to the assumption that the Black Sea was uninhabitable by fish; this is not correct, as pelagic species do live in the upper layers of water in the open sea. At one particular time, for

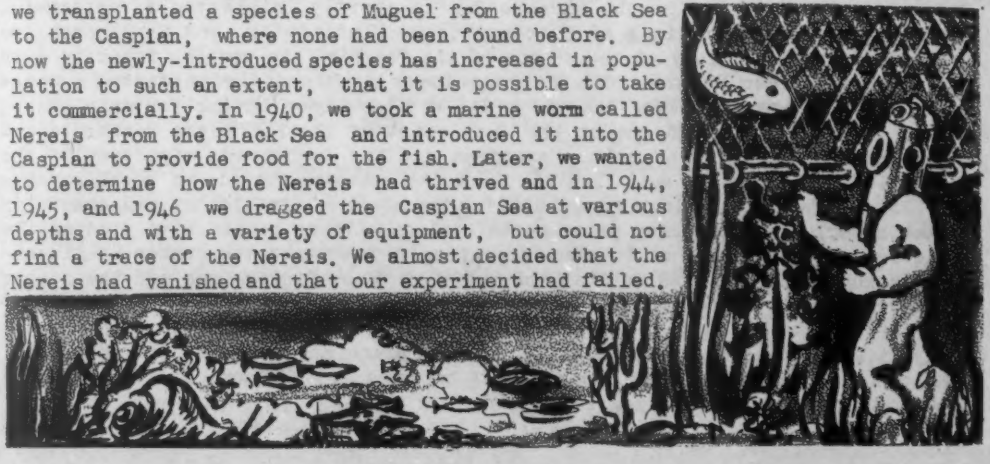
instance, the Pelamida population of the Black Sea was estimated at from 600,000 to one million tons, though this high figure is not necessarily representative.

Fish populations in the Caspian Sea are carefully studied. The spawning season in the northern waters of the Caspian are of great interest as a multitude of species come there to spawn. The fluctuation of the various populations is chiefly the object of study for the Institute, which is more interested in that than any actual count. Marine life on which the fish subsist is also studied--and its increase and decrease--because a knowledge of this food problem enables the Institute to predict the conditions into which the young fish will emerge each season.

What else do the workers at the Institute study? The rate of growth and the determination of the sexual maturity of various species are studied. A great deal of statistical material has been compiled, but the workers of the Institute are no less interested in actual observation of the habits and ways of fish. The dirigible, which we use for the location of schools of fish and seal herds, as I have said, is used for this purpose also, because it is practically noiseless and does not scare the fish away and, besides, it can come down right to the surface of the sea.

Behavior of fish in the vicinity of seines and traps is interesting. Fish are hesitant about approaching a seine, usually turning right or left some distance from it, although, of course, some manage to get caught in it. I remember my own observations when I was down at the bottom of the Black Sea in a diving suit; I discovered that fish in their local movements seemed to travel some unseen paths known to them alone. I would see a fish swim into my range of vision at some particular spot; it would proceed on its way, then lift at a certain point, turn left, swim on in that direction a while, turn again and finally swim out of sight. Then another would appear in the same spot and follow the same path, lifting where the first one lifted, making the same turns at the same spots, and go on its way, and a third would arrive following the same unseen path. I found that if I stood quite still the fish did not fear me, but, full of curiosity, would even poke their noses into the glasses of my headdress.

We have introduced species of fish from one body of water into another and we have done the same thing with certain species of marine life. For instance, we transplanted a species of Muguel from the Black Sea to the Caspian, where none had been found before. By now the newly-introduced species has increased in population to such an extent, that it is possible to take it commercially. In 1940, we took a marine worm called Nereis from the Black Sea and introduced it into the Caspian to provide food for the fish. Later, we wanted to determine how the Nereis had thrived and in 1944, 1945, and 1946 we dragged the Caspian Sea at various depths and with a variety of equipment, but could not find a trace of the Nereis. We almost decided that the Nereis had vanished and that our experiment had failed.



But in 1945, some sturgeon were caught and examined and their stomachs were found to contain numerous full-grown specimens of the Nereis. It appears that the Nereis is fed upon by the sturgeon in a very satisfactory way and has, in general, come to constitute a staple fish diet in the Caspian Sea.

To illustrate other types of work done by the Institute, I might tell you about one invention designed to protect nets anchored out at sea from rough weather. Storms at sea are hard on fish nets, as you know, so a net with what might be called "instinctive" properties was developed, which made it sink to some depth from the surface when a storm blew up and still deeper as the storm increased and the seas grew bigger; but, as the storm would abate the net would rise again to its previous position. Another problem was offered by a net reaching from shore to shore across the narrow strait of Kerch, where the fluctuating current cluttered the net with debris. How to ensure a clean net? A contraption was evolved which caused the net to tilt at an angle when debris accumulated, allowing automatic cleaning, so to speak, by the force of the current.

The end of the war confronted our Institute with a very great problem. During the war years, we had been called upon to supply great quantities of concentrated fish foods of all kinds to both the army and civilian population, but now nobody wanted these concentrated foods and clamored for delicacies. So we had to organize the switch from the concentrated products to the more tasty and higher quality items.

Before closing, a few additional facts regarding our Institute are:

Our Library in Moscow contains some 85,000 volumes. During the period 1935-1945, the Institute published some 4,200 separate books and pamphlets dealing with oceanography and fishery. Most of these were published either before or after the war, which, of course, seriously disrupted this work and it is only now that the Institute is resuming it on a large scale. The personnel of the Institute--headquarters at Moscow and the 18 stations--numbers 900, in round figures, including scientific and administrative personnel, seamen on the ships of the Institute and other workers; of these 900 employees some 350 are holders of various scientific degrees. I have given you these figures as I recall them and they may not be exact.

Mr. Holmes has asked me to add a few words regarding our work with salmon. Our station at Murmansk on the Barents Sea is cheifly interested in artificial breeding, while the stations at Petropavlovsk, Vladivostok, and Khabarovsk are interested in the biology of the salmon of the Pacific, the species found in both Soviet and American waters. The Petropavlovsk station, for instance, numbers among its staff two couples--man and wife--who have been living for many years, one on the east coast and one on the west coast of the Kamchatka Peninsula and observing the migration of salmon upstream and the downstream migration of the fingerlings. It must be said that the Kamchatka seaboard abounds in small streams and lakes, offering excellent opportunity for the study of the biology and chemistry of the spawning and breeding processes of salmon. These people have studied the ratio between the number of spawners migrating upstream and the number of fingerlings going downstream, as well as the ratio of these fingerlings and the number of mature fish later returning to the same stream to spawn. They have assembled much information on outside conditions affecting the spawning process and the early life of the salmon. Some of this information has already been published, some of it is being published now and just before I left Moscow, I went over some proofs of articles for publication.

Editorial Note: At this point Dr. Bogdanov read the following statement in English:

In conclusion, I would like to thank my American colleagues, who, like us, are interested in exploring and studying the seas and their inhabitants, for the kind reception and hospitality they have accorded me.

I sincerely hope that, in future, exchange of knowledge and literature between us and the development of personal friendships will further the work we are doing.

I attach especial importance to this development of personal friendships. The wartime friendship, which sprang up between our peoples, must grow into a peacetime friendship; and I think that these personal contacts that we workers in the field of science are establishing will greatly help in this direction.

At the conclusion of his talk, Dr. Bogdanov answered a number of questions. They follow:

Question: What is the approximate size of research vessels operated by the Institute and the total number?

Answer: There are 16 vessels of over 100 tons owned by the Institute.

Question: What is the main commercial species of salmon on the Pacific Coast?

Answer: Pink and chum; these two species account for 90 percent or more of the entire salmon population.

Question: What is the relative importance of canned, smoked, salted, and frozen fish?

Answer: I am afraid to quote any figures, but I may say that canning of fish is far less developed than here in the United States. A good deal of fish is smoked; a still greater percentage is salted, which does not yield a very satisfactory product with the exception of herring, which is better salted than in any other preparation.

Question: Is there any fish used entirely for byproducts instead of for food?

Answer: No. No species is used entirely for byproducts. However, some are used as bait in cod fishing in the Bering Sea; two species are so used.

Question: What is the annual production of fresh-water and marine fish?

Answer: I am unable to give you figures, which, however, will be contained in the publications which are to be supplied to you. No figures later than 1944 are as yet available. If we consider the northern part of the Caspian Sea (into which both the Volga and the Ural Rivers pour fresh water), as well as the Aral Sea and the Sea of Azov to be marine fisheries, then marine fish would account for 90 percent and inland fish for only 10 percent of the total catch. As to the relative position with respect to fish landings, the United States leads, with the U.S.S.R. coming second, while the position of Japan, which was first prior to the war, is now uncertain.

Question: What are the relative salinities of the inland seas of the Soviet Union?

Answer: The ocean has a salinity of 3.6 percent, the middle reaches of the Caspian, 1.2 percent; the Aral Sea, 1.2 percent; and the Black Sea, 1.8 percent; the upper part of the Caspian is practically fresh water.

Question: Has the Caspian Sea been reported to be declining in level?

Answer: There seems to be no progressive decline. It is a matter of historical cycles, the problem coming up seriously about 15 years ago, when we went to work on the historical, geological, and archaeological aspects of its behavior. It was discovered that in the vicinity of Baku there was merely a shifting of the sea from east to west and a matter of alternate cycles of elevation and depression of the sea floor. This curve is not complete and we do not know what point of the cycle we have reached. The recession of the water in the northern part of the sea has led to certain changes in the spawning grounds and influenced the fish population and we are now striving to counteract these effects.

Question: Have you ever had any chemical nutrients added in the inland seas?

Answer: No such work has been done. The inland seas are very high in nutrient material. The Sea of Azov has the highest yield of fish, for its size, in the world, with catches of 165 pounds per 12,500 square feet (75 kilos to 1 hectar).

Question: What is the ratio of your appropriation for scientific work to the total value of the fisheries products landed?

Answer: There is no lack of funds, although difficulties are encountered. One of the difficulties is various technical equipment, production of which was halted during the war years. There is a lack of workers, especially in the middle and lower levels, though there are enough scientific workers. As a matter of fact, expeditions are known to have been called off just because, while the leadership was there, workmen and laborers couldn't be had.

FEDERAL LEGISLATION, DECISIONS, ORDERS, ETC.

Department of the Interior

ALASKA FISHING REGULATIONS: Changes in the regulations for the protection of the commercial fisheries of Alaska during 1947 were issued on January 24 by Secretary of the Interior J. A. Krug.

These new regulations, recommended by the Fish and Wildlife Service, are based upon investigations of fishery biologists, fishery management agents, and testimony presented at public hearings conducted by the Service at eight places in Alaska and in Seattle, Washington.

Fishermen and operators in southeastern Alaska have been concerned for some time over the growing lateness of the pink salmon runs. Because the consensus of the testimony at the hearings was that this problem could be corrected only by allowing a larger proportion of the early-arriving fish to escape to reproduce themselves, the 1947 opening dates for commercial fishing in all districts of southeastern Alaska, except the Stikine District, will be two weeks to a month later than in 1946. Offsetting this to some extent will be a reduction in the weekly closed period from 60 to 36 hours. Provision is made also for extension of the fishing season in definite open periods alternating with closed periods, provided the runs are late and of sufficient volume to warrant fishing beyond the normal closing date. This method of handling possible extensions has been made applicable in the Alaska Peninsula, Kodiak, and Prince William Sound areas also.

Other changes in southeastern Alaska include several adjustments in district boundaries. All of Lisianski Inlet and Yakobi Island now are in the Western District; whereas, formerly they were divided between the Icy Strait and Western Districts. All waters south and east of the southern extremity of Kosciusko Island, including Davidson Inlet, Sea Otter Sound, and Heceta Island, have been transferred from the Sumner Strait District to the South Prince of Wales Island District, and the North Arm of Behm Canal has been transferred from the Southern District to the North Clarence Strait District.

Fall fishing throughout southeastern Alaska is restricted to the period from October 15 to November 15--two weeks shorter than in 1946.

Only one new closed area has been created in southeastern Alaska; this is Hole in the Wall on the north coast of Prince of Wales Island.

Trolling from Lituya Bay to Cape Spencer is prohibited prior to July 15 to protect small, under size king salmon that school there at that time of year.

In the Yakutat District, minor changes have been made in Ahrnklin and Situk Inlet gear restrictions to make them uniform.

Changes in southeastern Alaska affecting fisheries other than salmon include

(1) Closed seasons on herring fishing, except for bait and by gill nets, from May 1 to June 10 and October 16 to November 1;

(2) A uniform closed season on butter clams throughout the area from April 15 to September 15; and

(3) Closed season on shrimp fishing from February 1 to September 30 and closure of Duncan Canal to all shrimp fishing.

Elsewhere than southeastern Alaska there has been a minor change in the description of the area closed to salmon fishing in the Bering River-Icy Bay area; a reduction in the limit on razor clams to be taken in the Prince William Sound-Copper River areas from 46,000 to 40,000 cases; an elimination of the limitation on take of razor clams from certain central bars; the extension of the Prince William Sound area quota waters for herring fishing to include also the waters of the Resurrection Bay area; an increase in minimum depth of purse seines in Prince William Sound to 9½ fathoms and permitting of the use of leads 75 fathoms long, and the opening of the season in Prince William Sound 5 days later than in 1946.

In the Cook Inlet area, the opening date for king salmon fishing will be 5 days earlier than in 1946, and all salmon fishing will terminate 4 days earlier to give greater protection to expected small runs of pink salmon. Based on new surveys, the open areas for 4 traps have been redescribed. This will not permit any change in the actual location of these traps. Three new regulations have been added to protect Dungeness crabs in these waters. These new restrictions are identical with those in effect in nearby Prince William Sound.

In the Kodiak area, although relatively small runs of salmon are expected between Cape Trinity and Narrow Point and in the vicinity of Afognak Island, no additional restrictions have been imposed by these regulations. However, if these expectations are confirmed during the season, appropriate curtailment will be made in the field. Otherwise in the Kodiak area, the regulation limiting gill nets to a maximum mesh of 5¼ inches has been deleted, pending completion of studies in progress, and restrictions applicable to purse seines off the Karluk Reservation have been modified to correspond with those in effect during the 1946 fishing season.

The Alaska Peninsula area has been divided into 5 districts for administrative purposes; maximum and minimum depths of 175 and 120 meshes, respectively, are prescribed for beach seines; and a catch limitation of 700,000 red salmon is authorized in the Port Moller District.

A good run of red salmon is expected in all districts of Bristol Bay this year and regulations have been relaxed somewhat to allow the maximum economic use of the resource consistent with its conservation. The season in all districts except Ugashik will be from June 23 to July 23 while in the Ugashik it will be June 30 to July 30. The weekly closed period has been reduced from 72 to 60 hours, and the requirement of a maximum mesh of 5¼ inches has been deleted.

A new regulation, announced at all hearings, requires that each permit holder install and operate the trap at the site for which he has a permit, or if installed and operated by another, that he bear a substantial part of the cost of such installation and operation. The penalty for violation of this regulation is closure of the trap sites concerned.

Under these new regulations, each trap operator is required to file notice with the Regional Director of the Fish and Wildlife Service prior to February 15, 1947, that he has obtained or applied for a War Department permit. This date of filing is two months earlier than in 1946.

Department of Agriculture

FATS AND OILS: Increased domestic production of fats and oils is in prospect for 1947-48, the U. S. Department of Agriculture announced on January 15, but supplies available for consumption during the remainder of the current marketing season (October 1946-September 1947) will continue relatively small. If no major downturn in business activity occurs, prices of most fats and oils, except for seasonal declines in butter, are likely to remain high until mid 1947. However, prices probably will be lower in 1947-48. Beginning next fall, domestic output will be larger, and supplies in major exporting areas are expected to increase in 1947.

Federal Trade Commission

ROSEFISH: A 1944 order directing General Seafoods, Inc., and three of its subsidiaries to cease and desist from advertising and selling rosefish fillets as "perch" was vacated and set aside by the Federal Trade Commission on February 17, 1947, under Order 4627, citing its policy of cooperation with other federal agencies to avoid "possible conflict of effort."

The vacating order, which also dismissed the complaint, recited that the Commission had been advised by the Food and Drug Administration that the terms "ocean perch" and "red perch" have been accepted and approved by that agency as proper labeling for rosefish. "Such approval is, by specific legislation, made a direct responsibility of the Food and Drug Administration," the Commission noted.

Under the cease and desist order, the corporation and its subsidiaries had been prohibited from using the terms "ocean perch," "red perch," or "perch," either alone or in combination with other words, to designate, describe, or refer to rosefish or redfish.

After the cease and desist order was issued in November 1944, the respondents filed a petition to review and set it aside in the United States Circuit Court of Appeals for the First Circuit (Boston). Subsequently, after being advised in August 1946 that the terms "ocean perch" and "red perch" had the approval of the Food and Drug Administration, the Commission asked that the case be remanded so that its order might be vacated and set aside and the complaint dismissed. This request was granted by the court on February 4, 1947, without objection by the respondents.

Civilian Production Administration

AGAVE FIBERS: Restrictions on the use of agave fibers were tightened on January 16 by the Civilian Production Administration in an amendment to M-84 which limited sisal fiber to the manufacture of rope seven-eighths of an inch in diameter (2¾ inches in circumference) and smaller. At the same time, CPA relaxed end-use limitations on spinnable Manila fiber (abaca) to permit its use in the manufacture of all sizes of rope for any end use.

By this action, CPA expects to save agave fiber for the manufacture of binder twine, baler twine, and rope. The amendment does not prohibit the sale, delivery,

or acceptance of any rope made of agave fiber which was put into process prior to January 16, 1947.

Department of Commerce

EXPORTATION OF FISH AND FISH PRODUCTS: Certain fish and fish products have been deleted recently from the Positive List of Commodities requiring validated license for export, the Office of International Trade, Department of Commerce, announced in its Current Export Bulletin of January 24. For the convenience of exporters of these commodities, the fish and fish products (Schedule B. Nos. 007800-008698) which remain on the Positive List are listed below:

Schedule B. No.	Commodity
	Fish, salted, pickled, or dry-cured:
007800	Cod, haddock, hake, pollock, and cusk
	Fish, canned (the following classifications include only canned fish in containers that are hermetically sealed. These classifications include fish, salted, pickled, or dry-cured if packed in hermetically sealed containers. Report fish, salted, pickled, or dry-cured, packed in containers not hermetically sealed, under 007700, 007800, 007901, 007903, and 007998):
008400	Salmon
008500	Sardines (include pilchards)
008603	Herring
008698	Mackerel, bonito, tuna and tuna fish flakes

Food and Drug Administration

CANNED OYSTERS: The Food and Drug Administration, Federal Security Agency, announced on February 3, 1947, that a hearing would be held as soon as practical on proposals to adopt definitions and standards for fill of containers for all canned oysters.

At present, the standard applies specifically to oysters that average less than $\frac{1}{2}$ ounce per oyster. Since some packers are now packing oysters which average more than $\frac{1}{2}$ ounce per oyster, they are now not subject to the regulations on fill. The total weight of oysters per can for the larger sizes has not been uniform. For additional information, interested parties should write direct to the Food and Drug Administration.

RECENT FISHERY PUBLICATIONS

Listed below are informational publications which recently have been processed by the Division of Commercial Fisheries. FL publications are available, free of charge, from the Fish and Wildlife Service, Merchandise Mart, Chicago 54, Ill. Other listed publications may be obtained, also free of charge, from the Division of Commercial Fisheries, Fish and Wildlife Service, Washington 25, D. C.

Number	Title
CFS-307	New England Landings, September 1946
CFS-309	New England Landings, October 1946
CFS-310	Maine Landings, October 1946
CFS-311	Current Fishery Trade, August 1946
CFS-312	Fish Meal and Oil, November 1946
CFS-314	Vitamin A Report, October 1946
FL-212	A Rapid Test for Vitamin A Stability (formerly Sep. No. 129)

Reprints (Separates) from Commercial Fisheries Review, January 1947.

Sep. No. 159 - The Location of Sardine Schools by Super-sonic Echo-ranging
Sep. No. 160 - Bacteriological Studies of Oyster Conditioning
Sep. No. 161 - "S. S. Pacific Explorer"--A Preliminary Description
Sep. No. 162 - Receipts of Fishery Products at Chicago, 1945
Sep. No. 163 - Preliminary Procedures for the Analysis of Vitamin A in Fishery Products

Designations for fishery publications are interpreted as follows:

CFS - Current fishery statistics of the United States and Alaska.

SL - Statistical lists, consisting of lists of dealers of fishery products and manufacturers of byproducts.

FL - Fishery leaflets.

MDL - Market development lists of frozen food locker plants and locker associations.

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MACKEREL STUDIES

MACKEREL

Research Report No. 1: "Studies on the Handling of Fresh Mackerel," by Maurice E. Stansby and James M. Lemon (1941).

The mackerel (Scomber scombrus Linnaeus) is now in season. It is one of the most important food fishes of the United States. It has been difficult, however, with the present handling methods, to sell the entire catch at a profit.

Spoilage is more complicated in mackerel than in many other species. Mackerel keep longer when eviscerated and packed in finely crushed ice, than when floated in the round in sea water containing a little ice. Recommendations for improvement of handling methods are discussed in Research Report No. 1.

Research Report No. 6: "Preparation and Keeping Quality of Lightly Smoked Mackerel," by Maurice E. Stansby and Francis P. Griffiths (1943).

Lightly smoked mackerel is similar to finnan haddie or kippered salmon. The mild smoke flavor blends with, but does not overshadow, the mackerel flavor. The product is very perishable, but the time during which it can be kept can be extended up to 6 months by proper freezing and storage. The preparation and storage of lightly smoked mackerel is discussed in Research Report No. 6.

These Research Reports may be obtained free from the Fish and Wildlife Service, Merchandise Mart, Chicago 54, Ill.

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